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The OIL AND GAS JOURNAL

SEPTEMBER 1, 1958

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Bottom-hole troubles plague G.P. in California project p. 106

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A JOURNAL EXCLUSIVE

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p. 129

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The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Sept. 1, 1958

There's one explanation for current crude-price cuts:

And they don't reflect a general weakness in the market.

Refiners, pinched by weak product prices and dropping plant realizations, are evaluating their crude streams.

The result is they are just paying less for the crudes which give the less profitable yields. They also are cutting premiums for the more desirable crudes where substitutes will give nearly as good yields.

Price cutting currently is centering in the southern coastal regions of Texas and Louisiana. Adjustments were made earlier in northern Louisiana, Arkansas, the Rockies and Illinois basin. Oklahoma and Kansas saw an upward adjustment on some crudes cut months earlier.

So far, these trends stand out: Premiums have been removed from condensates and higher-gravity crudes...Prices still are above their pre-Suez levels...Majority of crudes even still carry the average 25-cent increase posted in early 1957.

You can expect this crude evaluation to continue.

The pressure is too great for crude prices long to remain static. Some crudes will rise in price, some fall either because of their changing yield value or from the pressure of competition from other crudes.

Future price changes for crudes may be dictated by their value in processing for high-octane gasoline or by their value in the upcoming big market for jet fuel.

In fact, oil economists have the entire crude-pricing system under study.

So far they haven't hit on a better pricing method. What they'd like: A better plan than the gravity system of valuing oil and a seasonal price for crude.

▼ ▼ ▼

PRODUCERS in the next few years can expect some great advances toward maximum recovery (p. 171).

Engineers admit their knowledge about the reservoir is still inadequate. Their research is centering on finding out more about:

...Wettability of rocks to determine the efficiency with which water will displace oil.

...Use of wetting agents and surface active agents to increase recovery through water flooding.

...Reservoir inhomogeneities, such as fractures and stratifications.

...Inexpensive materials which are miscible with both oil and water, such as alcohols and carbon dioxide.

When you add these research areas to work now being done on water flooding, LPG flooding, fire flooding, etc., the importance of the gigantic campaign is apparent.

Two recovery projects currently are in the news:

...A water flood at Cogdell Canyon Reef Unit in West Texas is showing excellent performance since water was injected 2 years ago. It will add 60 million barrels of oil to the field (p. 112).

...A fire flood experiment by General Petroleum in South Belridge field, Kern County, Calif., is proving large quantities of oil can be recovered but the cost is high (p. 106).

▼ ▼ ▼

One of toughest wells in DRILLING history is proving to be the 1A Killam, drilling on the flanks of the famous Precadito salt dome in Webb County, Texas (p. 110).

Tough factors of depth, heat, high mud weight, and small hole have all combined in this one well. For instance, it has drilled:

...More than 3,300 ft. of hole with mud weighing more than 19 lb. per gal.

...More than 2,500 ft. of 4 9/16-in. hole below 16,500 ft.

...Formations with temperatures above 400° F.

▼ ▼ ▼

EXPLORERS can take a lesson from a new five-pay field uncovered in McClain County, Okla. (p. 213).

Kirby Petroleum's 1 Weeden has come up with four pay zones. The first offset has found a fifth.

But the exploration technique is the important thing about the wells. A two-gun approach was used:

...Subsurface geological study of nearby dry holes and fields indicated a prospective area lay hidden.

...Seismic lines confirmed the hunch with a nice picture of structural uplift.

The resulting strike lies on an anticlinal fold, complicated by faulting. It's an example of what can be gained with combined geological-geophysical approach to exploring in older oil areas.

▼ ▼ ▼

Cost of sucker rods is up from 4 to 6.9%.

Their prices have joined those of tubular goods in rising

after the midyear boost in cost of steel. Oil men can count on other equipment items they buy also priced higher by fall.

New price list for sucker rods f.o.b. Tulsa, per 100 ft.:

	Old Price	New Price	% Rise
Alloy steel with couplings:			
⅝-in.	46.70	48.65	4.2
¾-in.	59.20	61.70	4.2
⅞-in.	75.80	79.00	4.2
1-in.	97.95	102.25	4.4
Carbon-manganese:			
⅝-in.	34.80	36.30	4.3
¾-in.	44.40	46.30	4.3
⅞-in.	56.60	58.85	4
1-in.	84.20	90.05	6.9

Add payrolls to the list of rising costs.

Each employe next year will cost you $25.50 more under the new social-security tax measure. Cost will go up another $24 the next year. And the employe also will be nicked for like amounts.

Present tax is 2¼ per cent of earnings up to $4,200 each on both the employer and employe. This jumps next year to 2½% on earnings up to $4,800. Another one-half per cent is scheduled for 1960 and further one-half per cent increases are due in 1963, 1966, and 1969.

In 10 years 9% of the payroll will be pouring into the social-security program even if no new benefit increases are voted in the meantime.

▼ ▼ ▼

ALL REFINERS may get imports quotas based on a percentage of their crude throughput. That's the new control plan being studied to replace the present system (p. 101).

The industry will get the full details from Washington officials soon. Oil men also will get a chance to give their view on the idea. Target date for the switch is January 1.

Here's how plan would work:

Refiners would be assigned quotas. Those who can't use foreign oil could trade their quotas to coastal refiners who want them. Theoretically, all would benefit from economic advantages stemming from the cheaper crude.

Reason behind the new approach: Present quota system is showing signs of breaking down under flood of new requests.

OCAW defeat in union election at American Oil Co.'s Yorktown, Va., refinery has more significance than just an ordinary plant election.

Workers voted 117 to 74 in favor of affiliation with the Independent Oil Workers of Virginia.

Significance: This makes Yorktown the only non-OCAW

plant among Amoco's six refineries. The union thus is deprived of company-wide leverage in its bargaining strategy.

Look for epoxy resins to find favor as interior coatings on floating roof tanks.

Refiners' initial reaction to their use is enthusiastic. The resins provide a smooth, tough, corrosion-resistant surface.

One point to remember: Install a grounding circuit between roof and tank. Most plants rely on contact of roller shoes on roof to supply adequate surface in contact with the tank shell. A grounding circuit is needed because epoxy resin will be a nonconductive barrier.

▼ ▼ ▼

PETROCHEMICALS have felt the sting of general business recession—but have fared much better than most.

Both tonnage and value of output for 1958 will show increases over 1957 ranging from 5 to 6%.

Looking ahead to 1960, output should be up 25%.

By types, this is the petrochemical outlook:

...Aliphatics still is largest group with steadiest growth rate. Output is up 6.6% this year. Prices are steady.

...Aromatics shows 5.4% gain in output, prices steady.

...Inorganics lag with only 2.8% output gain. Price decline in styrene and price weakness of benzene, toluene, and xylene tend to lower average value (p. 126).

Microtubing as small as a human hair is now being produced by Monsanto. It's offered as Santotube Q.

Tubing is made of quartz, is three one-thousandths of an inch in diameter. It's so flexible it can be tied in knots, has greater tensile strength than steel.

The microtubing is the heart of Bell Laboratory's diffusion cell which promises a way to recover 4 billion cubic feet of helium now lost annually in natural gas (OGJ, May 19, p. 107). The production-scale cells each will need 1.5 million miles of the tubing.

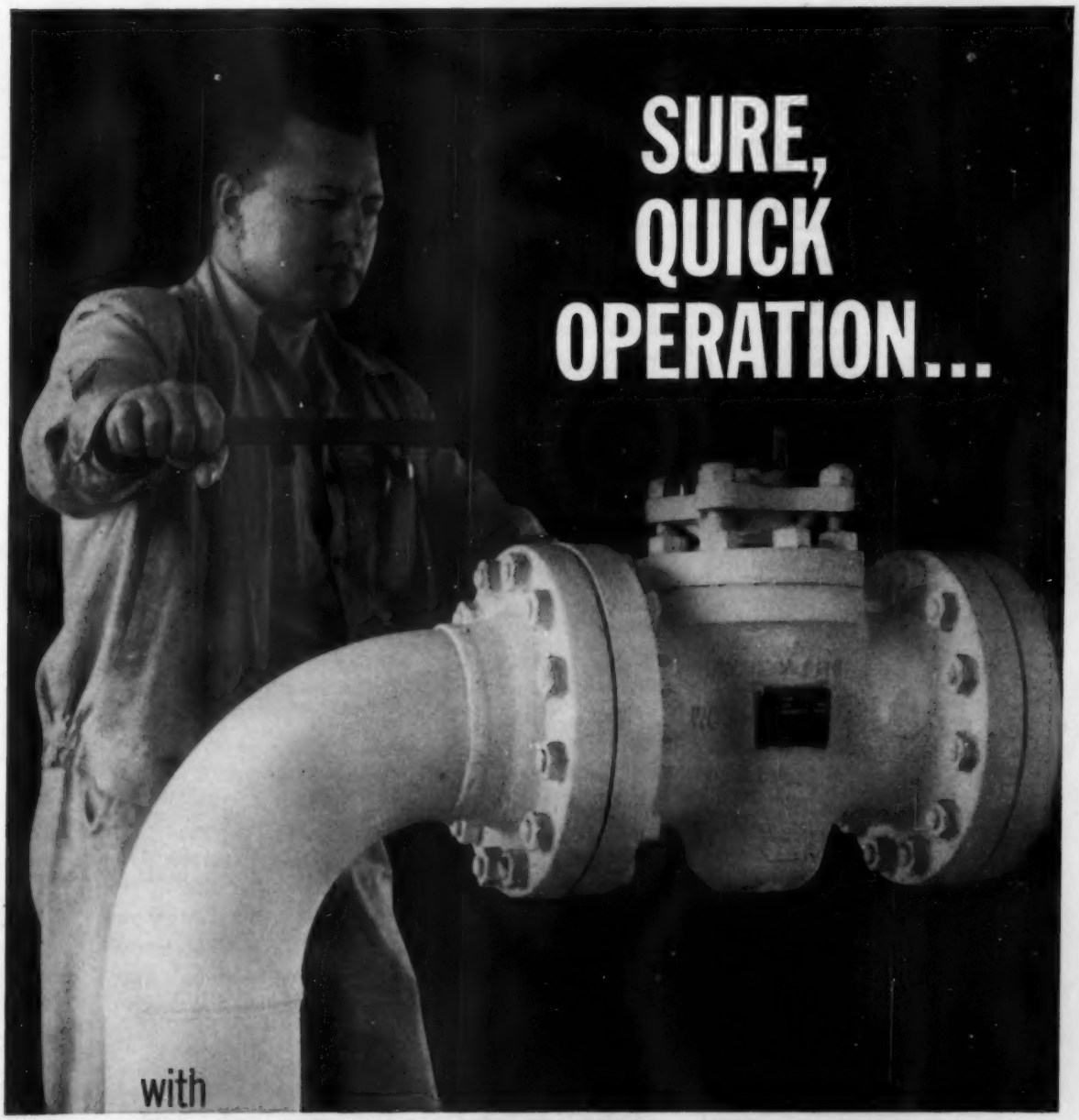
▼ ▼ ▼

Indications mount that Texaco has a major discovery in its Gulf of Paria well just off the Trinidad shore.

Texaco Trinidad started drilling in May on first of 36 wells planned for a mammoth permanent platform. Site is in 68 ft. of water 1½ miles off Brighton terminal pier (OGJ, July 14, p. 83).

Now Mid-Continent Supply is building a 100,000-bbl. production barge to be towed to Gulf of Paria. It reportedly will be used to move production to shore and to accommodate new wells during testing.

The Oil and Gas Journal is published weekly by The Petroleum Publishing Co. 211 S. Cheyenne, Tulsa 3, Okla. Second-class mail privileges authorized at Tulsa, Okla. United States and foreign rates to the petroleum industry, 1 year $5, 2 years $8, 3 years $10.



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the OIL AND GAS JOURNAL

SEPTEMBER 1, 1958 • VOLUME 56 • NUMBER 35

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POSTMASTER: Send notification (Form 3579) regarding undeliverable magazines to The Oil and Gas Journal, 211 S. Cheyenne, Tulsa 3, Okla.

SUBSCRIBERS: Send subscription correspondence and change of address to The Oil and Gas Journal, 211 S. Cheyenne, Tulsa 3, Okla. Subscribers should notify publisher promptly of any change of address, giving old as well as new address, and including city postal delivery zone, if any. If possible, enclose an address label from a recent issue of the magazine. Allow one month to six weeks for change to become effective.

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PETROCHEMICAL REPORT

Petrochemicals on the Move 126

By Dr. R. L. Bateman

Petrochemicals have done better than most industries in the recession with both tonnage and value of output to show increases of some 5-6% in 1958 over 1957. Surplus capacity is a new experience, but additional investment is required to commercialize new research and development discoveries. Steadiest growth will continue to be in the aliphatics.

Petrochemical Survey 129

Here is the Journal's sixth annual survey of petrochemical plants, raw materials, and products for the United States and Canada. It is arranged in six handy tables. Want to know what plants make ethylene? Just run through Table 1—Organics and you can pick them out in a hurry. Capacities given where available.

Pipelines Find Favor in Transporting Ethylene 150

By Dr. H. C. Schutt and A. R. Mattioli

This is the concluding part of a three-part series on ethylene storage and transportation. Transmission by pipeline through special metering station is discussed, also possibility of shipping liquid ethylene in the future by barge or tankers.

TECHNOLOGY—OPERATION

Yugoslavia: Young Oil Province with Good Undeveloped Prospects 156

By George de Mohrenschildt

The search for oil is restricted to relatively limited sedimentary basins in Serbia, Montenegro, Bosnia-Herzegovnia, and Croatia.

Visual Aids Speed Turnaround 159

By Larry Resen

To expedite refinery turnarounds Cosden Petroleum Corp. implements the usual careful planning with detailed sketches of equipment. An example is the HF alky turnaround for which a drawing of the unit (detailed elevation) and a supplemental turnaround folder were used to good advantage.

Questions on Technology 165

Microwave System for Four Corners 166

Four Corners Pipe Line Co., for which Shell Pipe Line Corp. is construction and operating agent, uses a microwave "backbone" system located along the mountain tops with laterals to connect the intermediate pump stations.

Nelson Refinery Construction Index 170

Maximum Recovery—How Far Have We Come? 171

By V. E. Stepp and E. R. Brownscombe

Only a start has been made in understanding the oil and gas reservoir. Looking ahead we need more knowledge on rock wettability, surface forces related to wettability, reservoir inhomogeneities, an inexpensive agent miscible with both oil and water, and use of carbon dioxide.

Analyzing Cementing Problems 179

By E. H. Clarke, Jr., and A. S. Murray

This is Part 2 of a series and gives data from a Saskatchewan well to illustrate method of analysis and corrective measures that could have been taken.

On The Job . . . Pipelining: Great Lakes Employes Learn About Fire Fighting 183

How Great Lakes Pipe Line Co. supplements advanced training of supervisors in fire-fighting techniques.

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Photo: *The British Petroleum Co., Ltd.*

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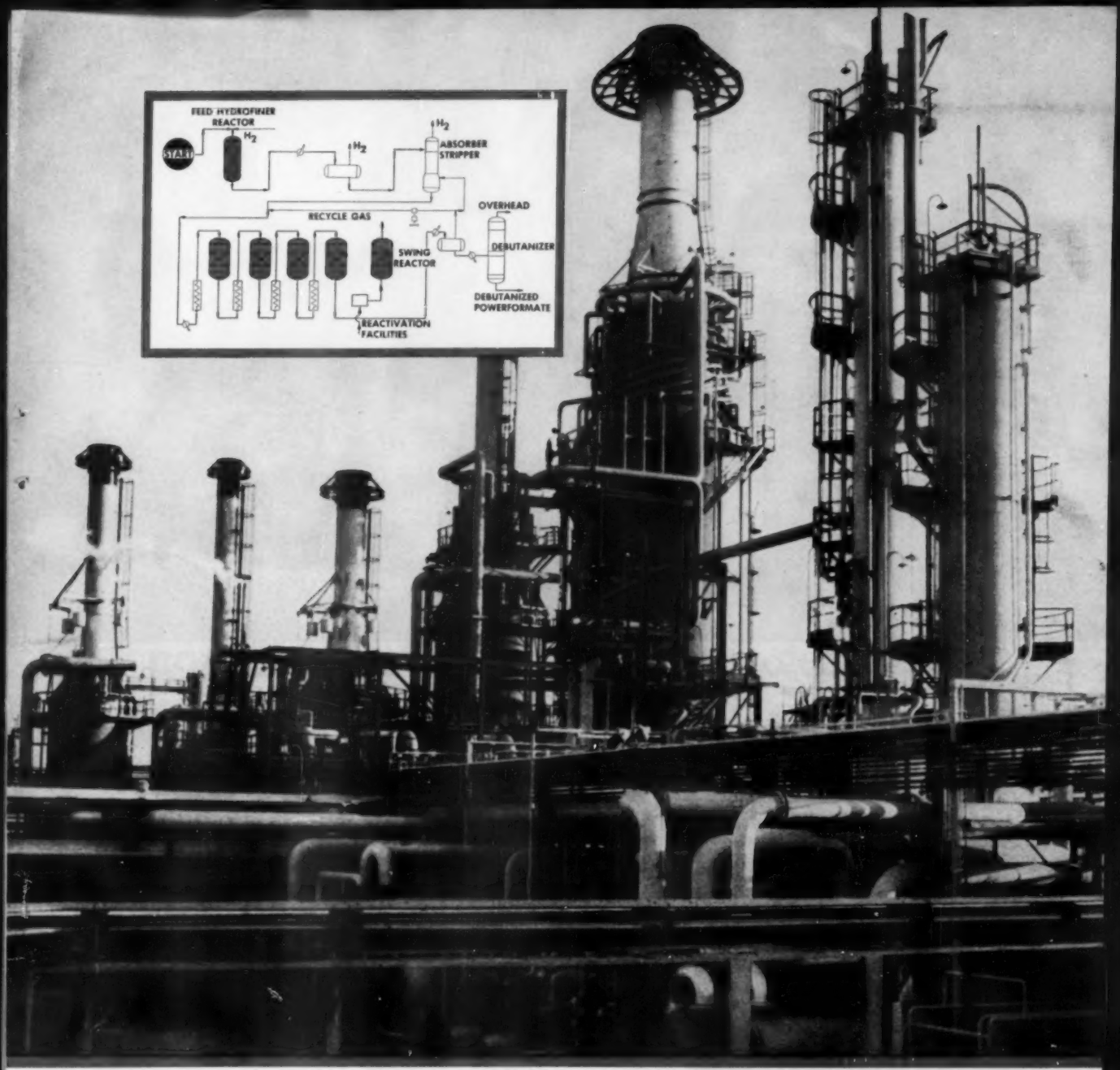

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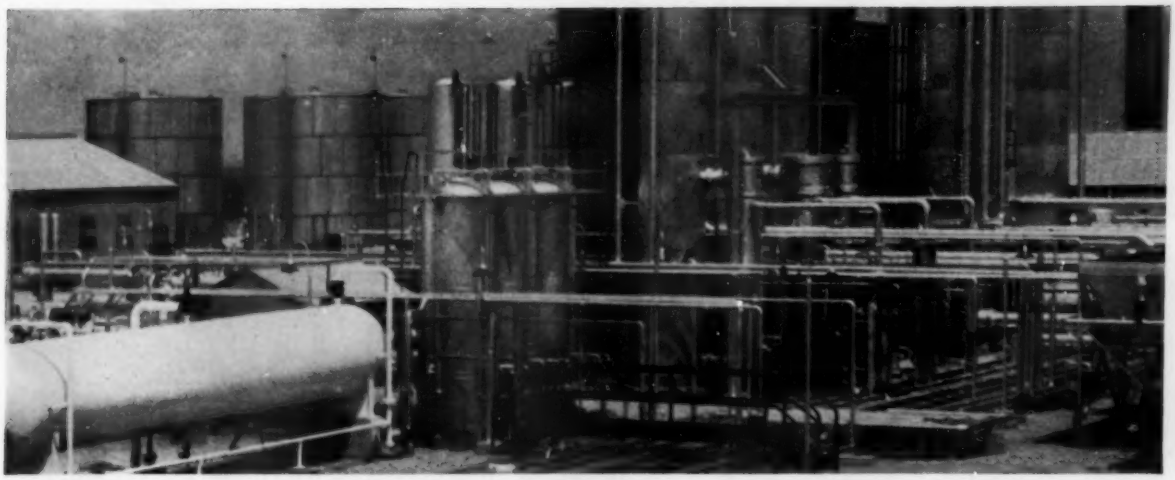

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- Packers may be set on tubing or electrical or sand line, as desired.
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Is multi-pass shell construction practical in heat exchanger design?

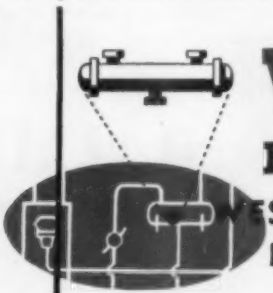
Question:
Are the design features of multi-pass shell construction sound and applicable for process heat exchangers?

Answer:
***Yes, if properly designed and applied,* multi-pass shell heat exchangers effect substantial savings in initial installation costs. Western has been successful with multi-pass shell construction because . . .**

. . . of a thorough knowledge of the applications for which each Western heat exchanger is designed. Consequently, Western two-pass shell exchangers are recommended and specified only for those applications where they are ideally suited.

Western multi-pass shell exchangers have achieved satisfactory service for our customers at far lower investment cost. By reducing the number of shells required to handle specific applications, the Western multi-pass shell exchanger does the work of two exchangers at substantially lower initial cost.

A Western representative will gladly advise you as to the possibility of applying two-pass shell construction to your next heat transfer requirements.



WESTERN
HEAT EXCHANGERS
WESTERN SUPPLY COMPANY
P. O. Box 1888 – Tulsa, Oklahoma

Says Maintenance Foreman of large gas processing plant.

W-K-M's new ACF® non-lubricated BALL VALVE

This new product of W-K-M's *Creative Engineering* has been service-proved with these ladings.

Acetate • Crude ammonia liquor • Aviation fuel and Stoddard solvent • Propane • Toluol • Methylethylketone (MEK) • Alkaline slurry • Jet engine fuel (test cells) • Naphtha and coal tar solvents • Paint cleaner and thinner • Liquid soaps, DDT and chlordane • Vinyl chloride • Butadiene liquid • Copper ammonium acetate • Carbon bisulphide • Cleaning naphtha • Lime and soda ash slurry • Riboflavin media • Gasoline (tank truck) • Helium gas • Coke oven by-product gas • Gasoline (tank car) • Chlorinated solvents.

For 3½ years, users tested this new valve in the hardest services that could be found.

Now, W-K-M offers it to you as a **service-proved** new product, a new product with no bugs, a typical example of W-K-M's leadership in design, production and service.

This valve will deliver promised performance; you can specify it with complete confidence in its efficiency, economy, ease of operation and maintenance.

You should know more about it.

Write for Catalog 1000 for complete information.

AVAILABLE in carbon steel (ASA 150 lb., 300 lb.), and semi-steel (200 lb. WOG, 400 lb. WOG); sizes range from ½" through 6". Also ASA 600 lb., sizes ½, ¾ and 1".

W-K-M

DIVISION OF ACF INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

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THERE IS A DIFFERENCE

IN UNIONS -

Look at WECO!

You'll see the difference in their carefully machined seats, the accurately cut Acme threads, the precision machined pipe ends, the deep knurling on the subs that assure safe positive wrenching.

You can't see or feel the rigidly controlled heat treatment but you will know it's there when your WECO Union seats and seals perfectly after hundreds of make-up and break-outs.

Study the design, see how the ball and cone seats always *assure* a positive, full-circle, metal-to-metal seal.

Ask your supply store man about WECO Unions. They are available everywhere in a full range of sizes and pressure ratings. Now is the time for you to standardize on high quality WECO Unions.

U-6-58

WECO®

WELL EQUIPMENT MFG. CORP.

HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

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FOSTER WHEELER *in Europe...*

Three major petrochemical installations in England, France and Denmark for the production of ETHYLENE and BUTADIENE—designed, engineered and constructed by Foster Wheeler.

Complete facilities for process plant design, engineering, fabrication and construction are available through Foster Wheeler Limited, London, and Société Foster Wheeler Française, Paris.

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It's the handiest, most economical power-producing package in its class ...ANYWHERE

NEW 35-kw generator set from Allis-Chalmers

You Can TAKE It Anywhere — One compact, integral unit — engine, generator and switchboard. Only 68 x 25 x 37 in. over-all. Fits easily into a pickup truck or slides from place to place on steel skids. Runs on gasoline or gas.

You Can WORK It Anywhere — indoors or out. Engine is fully protected from snow, dust or rain — generator is weatherproof. Switchboard is cabinet-enclosed to guard against weather, dust, tampering. Set needs no special skill to operate—just connect the load.

You Can SERVICE It Anywhere — It's easy to service this simple, tractor-rugged engine. Even when a complete overhaul becomes necessary, its "wet" removable cylinder liners are low-cost and quickly replaced. What's more, you are never far from a source of original Allis-Chalmers parts.

But You CAN'T MATCH ITS VALUE — ANYWHERE — Compare in on any basis you choose — low invested cost per kilowatt, high economy per kilowatt produced and greatest engine life per dollar. This set has a heavy-duty engine specially built to operate long hours in the steady grind of generator work.

...the G-226 POWER PACKAGE

ENGINE:
Allis-Chalmers industrial POWER-CRATER engine
60 bhp at 1,800 rpm

GENERATOR:
3-phase, AC current, 35 kw
Single phase, 23 kw

DIMENSIONS:
68 in. long,
25 in. wide, 27 in. high

WEIGHT:
1,645 lb

A PREMIUM SET AT ECONOMICAL COST!

POWER-CRATER is an Allis-Chalmers trademark.

Let your Allis-Chalmers dealer explain the many other reasons why the new G-226 is the best buy in its class — anywhere. Send for Bulletin BU-412. No obligation. Allis-Chalmers, Milwaukee 1, Wisconsin.

BG-27

ALLIS-CHALMERS

HOW TO SETTLE YOUR EMULSION PROBLEMS!

Emulsions hold dollars in suspense . . . by slowing down processes, by wasting products and by causing losses in manufacturing time.

But most emulsion problems are not only unnecessary, they can be cured—as the Tretolite Company has been demonstrating for nearly half a century.

These years of specialization in the development of demulsification chemicals and services have taught us that there is no one-time, sure-fire, cure-all. They have provided us, however, with a wealth of knowledge regarding the manifold problems and secondary considerations attending emulsifications. They have also enabled us to develop literally thousands of demulsification compounds for the petroleum industry, as well as for the chemical, pharmaceutical, mining and other industries.

If you have a specific problem, you are invited to write us, describing it, and sending a sample of the emulsion; listing ingredients, temperatures, pressures, etc., along with a description of the operation by which the emulsion was formed. Address your correspondence and samples to the attention of:

A. F. Wirtel, V. P. and Chief Chemist
Tretolite Company
369 Marshall Avenue
Saint Louis 19, Missouri

TRETOLITE COMPANY

DIVISIONS OF PETROLITE CORPORATION

369 Marshall Avenue, Saint Louis 19, Missouri
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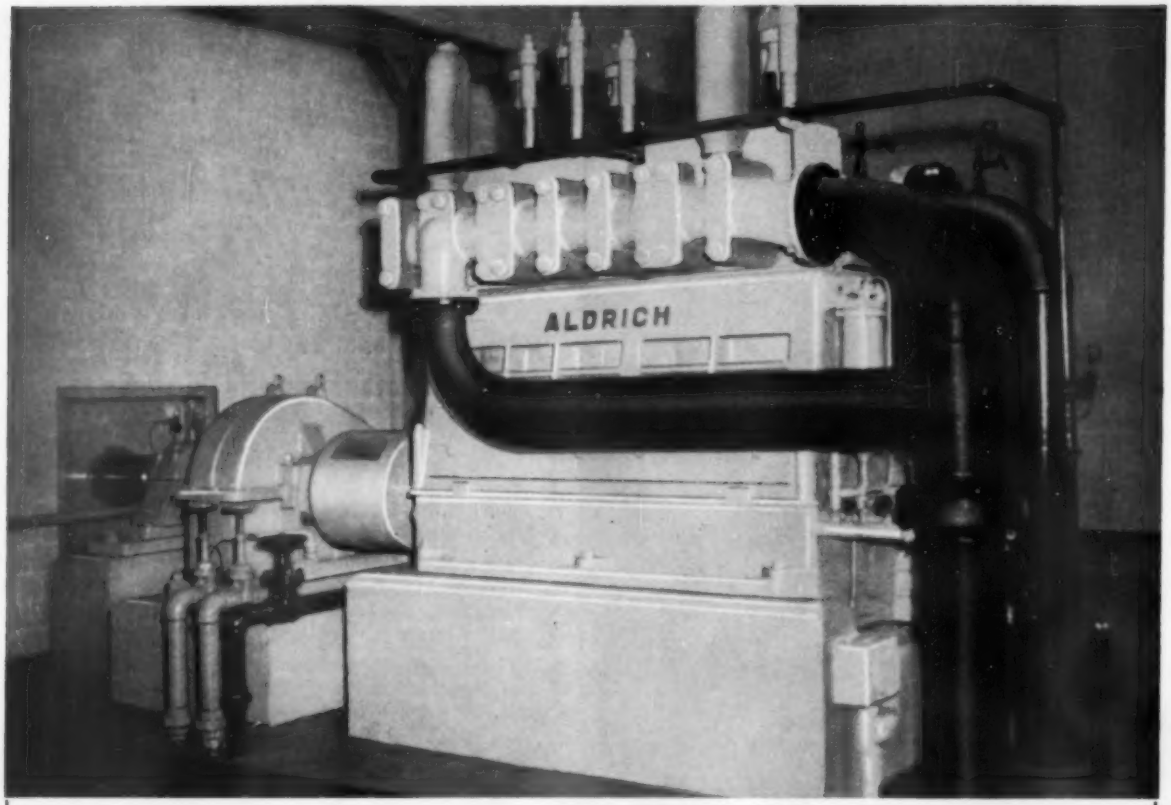
T-58-3



FIELD REPORT

APPLICATION: Pipeline Service

South Saskatchewan Pipe Line Company, Cantuar, Saskatchewan.

PUMPS: 3 Aldrich Quintuplex,

4½" plungers, 6" stroke. Each having a capacity of 20,000 b/d at 300 RPM, 1200 pounds pressure.

OPERATION STARTED: December, 1955

EXPERIENCE TO DATE:

Units pump viscous crude oil over 158 miles of 16" main line pipe. Customer reports exceptionally fine field service with routine maintenance only.

Field parts stock available in Carmi, Ill.; Charleston, W. Va.; Casper, Wyo.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH

NOT ONE FIELD CUT

in all This

MIDWEST

Shop-Fabricated Piping

...under a subcon...
and I would like to say the West Coast Division have on this job complied fully with the high standards of workmanship for which Midwest is known.

Throughout this entire project not once was a cut necessary to correct any piece of fabrication, and I might add in several instances close tolerances had to be met.

The above was not written on an impulse but as construction superintendent, this means but one thing: fast and low cost erection. Would appreciate your thanking Midwest personally for ...om a construction

Excerpt from letter by:
HOLMES & NARVER • Engineers-Constructors
828 South Figueroa St. • Los Angeles 17

Note particularly the words "*fast and low cost erection*" in the above letter. They characterize Midwest Shop-Fabricated Piping . . . whether for refinery, power plant or industrial installations. In this instance they were written by A. H. Chamberlain, construction superintendent, upon completing the installation of a Houdriformer Unit at the U.S. Oil & Refining Co., Tacoma, Washington.

There are three well-equipped Midwest pipe fabricating shops located to serve economically all sections of the country. Each is staffed by a highly skilled organization using the latest techniques. Each has wide experience on all kinds of projects so that the possibilities and limitations of all piping materials are well understood. You too will find it to your advantage to call in Midwest whenever you need fabricated piping.

MIDWEST PIPING SERVICE IS NATIONWIDE

MIDWEST PIPING COMPANY, INC.

Main Offices: St. Louis 3, Missouri (P.O. Box 443)
Plants: St. Louis, Clifton, N.J. and Los Angeles

SALES OFFICES:
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LOS ANGELES 33—520 ANDERSON ST. • MIAMI 34—2103 LE JEUNE RD.
NEW YORK 7—50 CHURCH ST. • PITTSBURGH 19, PA.—437 GRANT ST.
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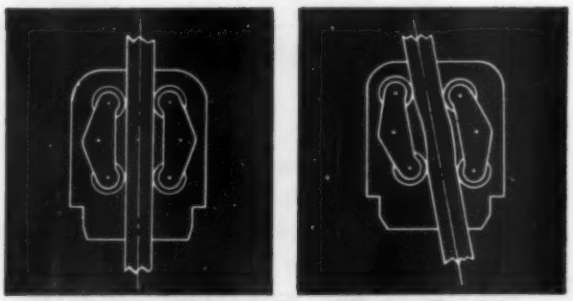
American Iron KELLY DRIVE-BUSHING

eliminates damaging Kelly whip and gyration*

SELF-ALIGNING . . . the pivoted-cage rollers in the new American Iron Kelly Drive-Bushing actually compensate for the small crooks and bends in the kelly! Now—for the first time—here is a kelly drive-bushing that assures centered kelly rotation above to the swivel . . . and below to the drill string! Unlike other multiple-roller kelly drive-bushings, the new American Iron kelly drive-bushing does not cause damaging whip and gyration movement to be transmitted to the crown block and below to the drill string!

Accurate Fit Without Adjustment at Rig!

There are no adjustments to make, no shims to put in or take out when installation is made on the kelly with the new American Iron Kelly Drive-Bushing. It helps the crew hold down-time to a minimum when changing kellys.



Exclusive Pivoted-Cage Roller Design greatly increases life of all rotating parts!

Get all the facts now from your American Iron Representative or your Supply Store man.

Self-Aligning Rollers

Four caged roller units (8 individual rollers) pivot at cage base pins to allow for nominal amount of kelly misalignment without introducing bending motion in kelly.

Positive Lubrication

All rollers are lubricated directly. No indirect lubrication system to become clogged and endanger both bushings and pins. No special grease is required.

Resulting from misalignment of rotary table or crooked kelly.

Another AMF Product
PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

AMERICAN IRON & MACHINE WORKS CO. INC. A OKLAHOMA CITY

Copon Arocoat—the Proven Epoxy-Coal Tar Coating

Unique formula cures quickly into a tough, tightly bonded, abrasion resistant shield against corrosive chemicals and fumes.

Copon Arocoat, the newest member of the Copon line of coatings specifically designed for corrosion control, is providing new answers for many of industry's toughest and most expensive corrosion problems.

Arocoat has been used profitably to cut traditional corrosion losses in paper mills . . . to add new life to condensate tanks and vessels, hopper cars, casing and conveyors . . . to provide internal or external protection for acid, alkali, sour crude and brine storage tanks . . . to reduce maintenance costs on cooling tower equipment. Economically applied by spray or brush, it has also been used to provide superior protection for marine equipment and submerged, buried and exposed gas and petroleum transmission lines.

If you have a corrosion problem that seems to defy profitable solution, get complete information on Copon Arocoat. Write today to the Copon Associate located nearest to your city.

Copon.

FOR CORROSION CONTROL

Normal Copon — the versatile maintenance coating • **Activated Copon** — for greater chemical resistance • **Copon Mastic** — high build for critical areas • **Copon Met-L-Pon** — the metallic zinc coating • **Copon High Bake** — the ultimate in chemical-resistant coatings.

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JAMES B. SIPE and COMPANY, INC.
P. O. Box 8010, Pittsburgh 16, Pa.

WILBUR & WILLIAMS COMPANY
130 Lincoln Street, Boston 35, Mass.

Mail to the Copon Associate located nearest your city.

_____Send complete information on Copon Arocoat.

_____I would like to discuss a corrosion problem with one of your technical representatives.

NAME_____

TITLE_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

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*Office only. No stock at these points.

Specify...

CONTINENTAL-EMSCO

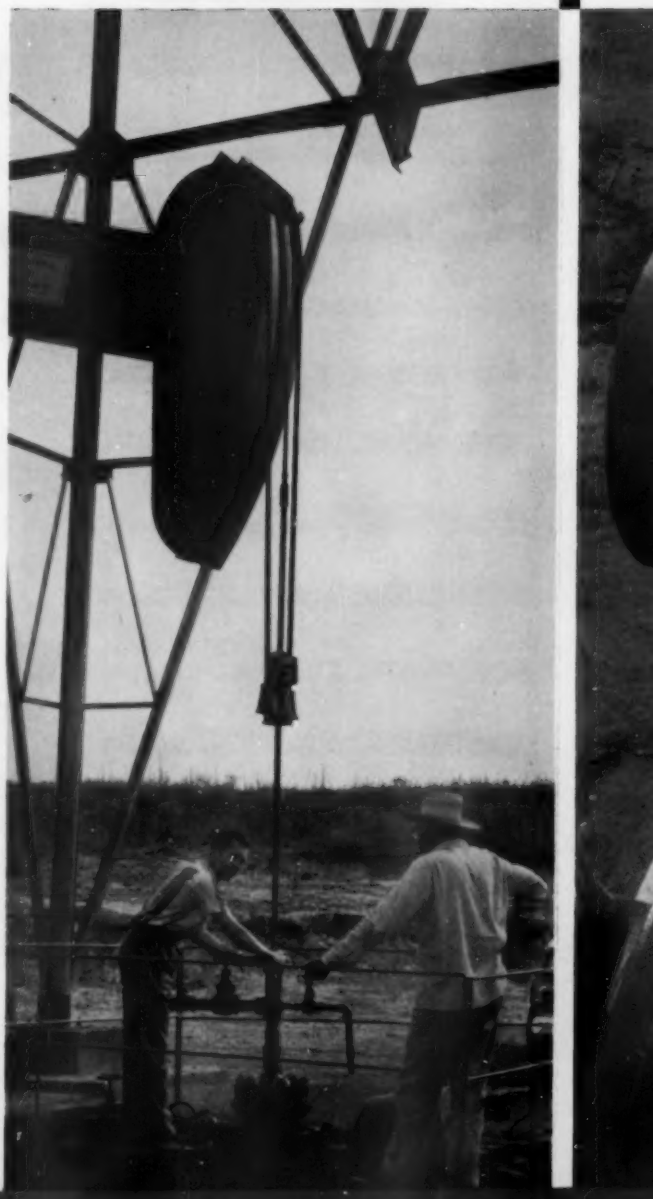
Specify THE ECONOMY PRODUCTION TEAM

..CONTINENTAL-EMSCO UNIT PUMPERS and SPECIALISTS

Your Continental-Emsco man sees that you get the *right* unit pumper for the job. He sees that it is *properly applied* with the right stroke length for maximum pump efficiency .. with the right strokes per minute to reduce rod failures and prevent excessive wearing of gears, belts and bearings.

Changing well conditions are easily met by C-E safe, ground-level counterbalancing .. economically done by one man. Here again, you can count on your C-E man. He weighs your wells, when necessary, to be sure you are getting maximum lifting efficiency at the lowest possible fuel or electrical cost.

For service before, during and after installation, specify Continental-Emsco unit pumpers ..



.. Equipment

Proper Attention Guarantees Longer Life for

GREEN TRIANGLE V-BELTS

Recommendations of your C-E service man on tension, alignment and operating conditions will greatly increase belt life. His advice as to the number of belts to use assures maximum power transmission and often cuts initial costs.

Proper belt adjustment is easy with GREEN TRIANGLE V-BELTS . . sold in *matched sets.* Since each belt is identical in diameter, length, thickness, material and freshness with others in the set, adjustment for one assures uniform adjustment for all.

New York Belting and Packing Company packs Green Triangle V-belts in matched sets . . *a performance plus feature* that costs no more . . exclusively at Continental-Emsco stores.

t that Hums

FIRST STEPS TOWAR

Specify..

CONTINENTAL-EMSCO D+B SUCKER RO

A rod for every well condition

If your purchasing system calls for "high tensile" rods from companies A, B and C rather than specifying exact rod grades, your rod strings are costing too much.

For example, Continental-Emsco medium-priced Type 5 rod can handle the same loads of many so called "high-tensile," higher-priced rods. Why? Because, Type 5 contains VANADIUM . . the amazing element that strengthens the rod, so it has greater load-carrying capacities than rods of similar properties *without* vanadium.

Call your C-E man. Talk over your rod requirements . . well conditions. His recommendations will reduce your pumping costs by (1) matching well conditions with the *right* rod, and (2) by giving you *higher quality* for longer service.

HI-TEN
For Heavy Duty in Extreme Corrosion

RELIANCE
For Heavy Loads in Severe Corrosion

TYPE 5
For Heavy Duty in Moderate Corrosion

HEATREAT #1 CM
For Medium to Heavy Duty Where Corrosion is No Problem

D+B API SUCKER ROD COUPLINGS

Strengthen this vital link

All Continental-Emsco sucker rod couplings are *lubrized* to protect coupling threads against corrosion and damage during make-up. These couplings are induction hardened for longer life and *100% inspected* before shipment . . to assure proper field make-up and your complete satisfaction.

for Service

RD LOWER-COST PRODUCTION

RODS

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Specify..

CONTINENTAL-EMSCO D+B SUBSURFACE PUMPS

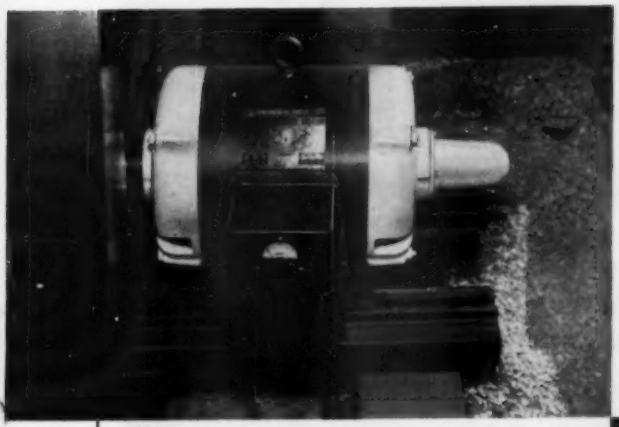
Assembled just for your well

The profit squeeze is on. No longer can you afford the luxury of *standard* pump assemblies.. often with metals of poor corrosion resistance, weak intermediate parts, or misapplication of pump materials.

Now, you need to take advantage of the full range of Continental-Emsco subsurface pumps ..37 types with over 700 variations. There's one to pump every well, efficiently and economically, regardless of depth, type of hole or corrosive, abrasive or gaseous conditions. Talk over your pump requirements with your C-E man.

Be sure to take advantage of C-E subsurface pump repair shops.. located in producing fields everywhere.

e that Sings..



Specify..

BIG ITEMS . . or small

Each Continental-Emsco store is individually stocked to meet the requirements of localized fields, so regardless of your lease location, you'll find all the items needed to do a better pumping job. Specialists are readily available to advise you on well-maintenance problems . . how to keep your production costs in line.

Specify..

C-E GREEN TRIANGLE ELECTRIC MOTORS . .

they're replacing many higher rated motors

After taking a close look, many major companies are standardizing on C-E GREEN TRIANGLE ELECTRIC PUMPING MOTORS. Here's why. They have a 40° C. rise and a *guaranteed 1.15 service factor* to handle unanticipated power demands. Their 5-8% slip and 275% starting torque reduce peak electrical loads. An exclusive *built-in* balance meter cuts well maintenance costs by making it easy to balance your wells . . see that they stay in balance. Rods and unit pumper are not vibrated apart as when pumping with an unbalanced well load.

This motor fits your pumping needs . . will cut your production costs. It's *oil field* tough . . *oil field* proven . . with Continental-Emsco *dependability* built-in.

Learn to rely upon your C-E stores for lower-cost production . . and *for equipment that hums . . service that sings.*

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide

P824

CONTINENTAL-EMSCO COMPANY • A Division of The Youngstown Sheet and Tube Company • General Offices Dallas, Texas
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..Go CONTINENTAL-EMSCO

JENKINS

O.S.&Y. U-BOLT GATE

MADE BETTER THAN NEED BE . . .

Costs Less to Use

YOU PAY NO MORE for the extra quality you see in every part of a Jenkins Outside Screw & Yoke U-Bolt Gate valve. Yet longer life and reduced maintenance is bound to result from the extra ruggedness, the precision manufacture and unique design features which Jenkins puts into these popular, general utility valves.

Choose the Outside Screw & Yoke pattern for services where spindle threads must be kept out of the destructive effects of fluids in the line; where spindle threads must be cleaned and lubricated regularly or where a rising spindle is needed to indicate wedge position.

Choose JENKINS, whether O.S. & Y. or Inside Screw pattern, for valves built to save maintenance dollars.

WIDE RANGE OF JENKINS U-BOLT GATES

GET FOLDER NO. 207 which describes Inside Screw and O.S. & Y. patterns . . . Iron Body with Bronze or Stainless Steel Mounting . . . All-Iron and Ni-Resist with type 316 Stainless Steel trim. Ask your local Jenkins Distributor or write Jenkins Bros., 100 Park Avenue, New York 17.

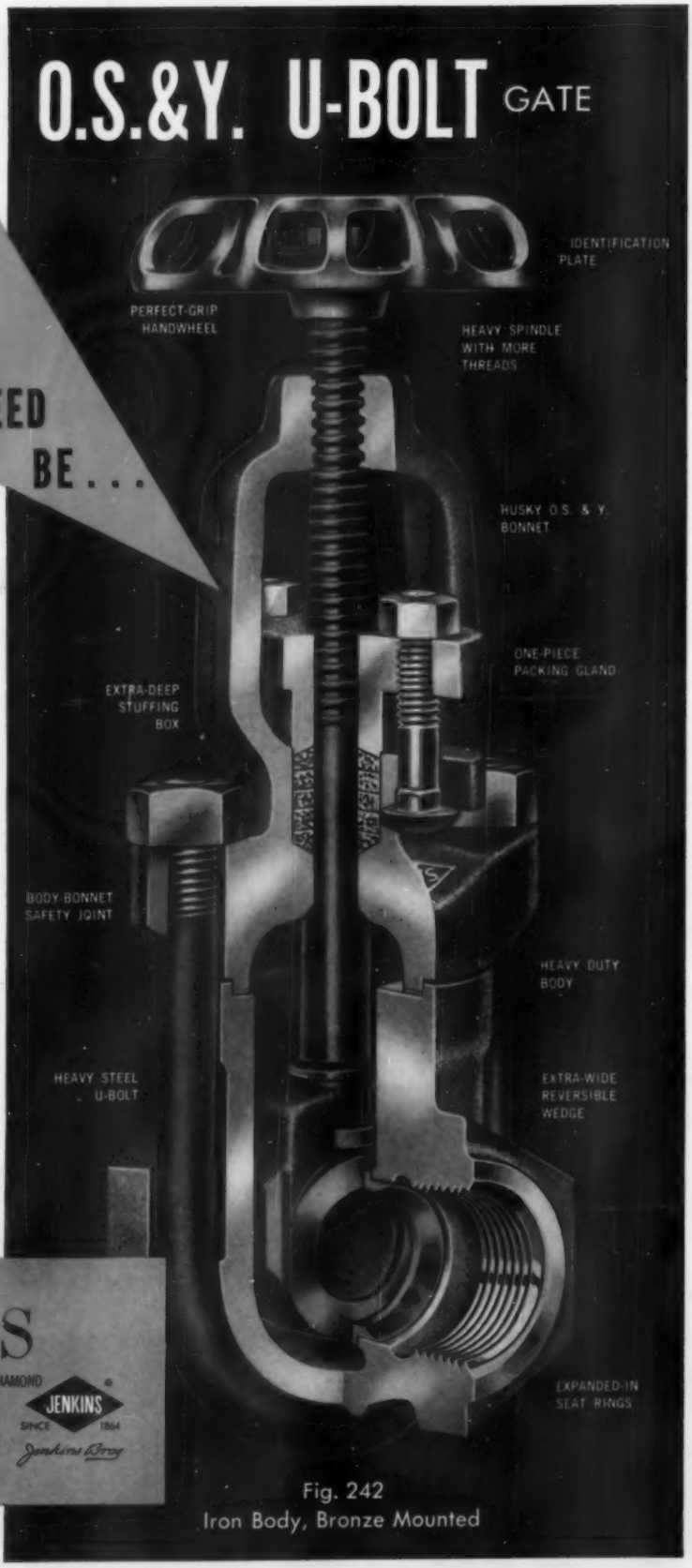
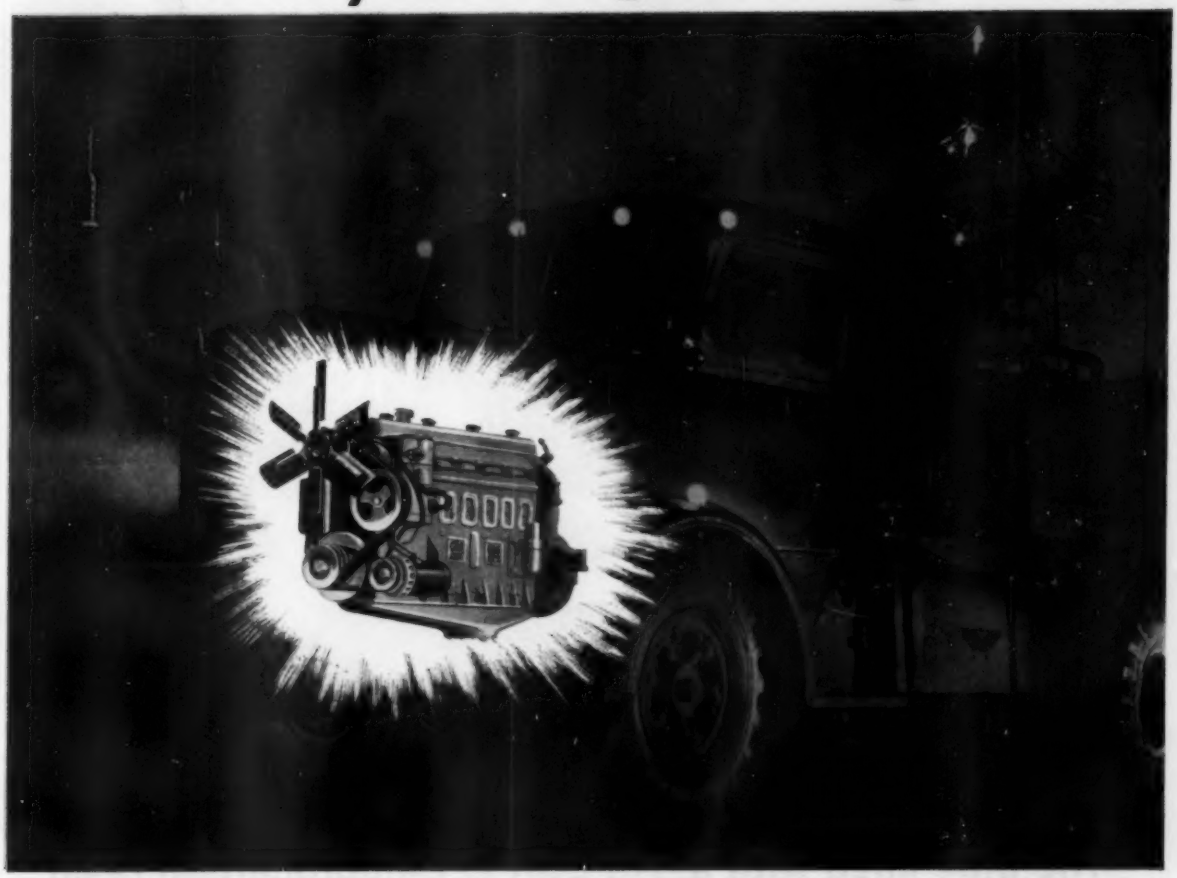


Fig. 242
Iron Body, Bronze Mounted

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864
Jenkins Bros.

Sold Through Leading Distributors Everywhere

New "Jimmy" Diesel gets a big hand!



New GM "71E" Diesel produces lower-cost miles than ever obtained before—now available for any make truck 26,000 GVW and up

You can't fool cost-conscious fleet operators, who often figure mileage costs to the third decimal point. They know when an engine is earning money—and saving money.

And, in ever-growing numbers, they're learning that this new "E" model of the famed GM 2-cycle Diesel is the most efficient ever built. Its new 4-valve combustion chamber—fed by new, more efficient fuel injectors—squeezes maximum mileage out of every drop.

With its snappy acceleration and reserve torque, this Diesel takes on all comers on tough hill climbs—outperforms them all on the level or at high altitudes. And its lower fuel input per horsepower means extra, trouble-free miles for your fuel dollar.

Want more facts? See your GM Diesel distributor about repowering your present equipment—gasoline or Diesel. When you're in the market for new trucks, ask for this great new GM "71E"* engine.

And if the truck you choose isn't immediately available with a "Jimmy," turn it over to the GM Diesel distributor for a "71E" installation. *You'll be money ahead.*

**Truck and bus engines: "4-71E"—140 h.p.; "6-71E"— 210 h.p. New Turbopower models utilize the energy of exhaust gases to deliver even higher power: "4-71T"—171 h.p.; "6-71T"—236 h.p.*

Now—more than ever *—it pays to standardize on GM Diesels*—available in more than 1800 applications of power equipment built by 250 manufacturers.

GM
GENERAL MOTORS
DETROIT DIESEL POWER

1908 1958

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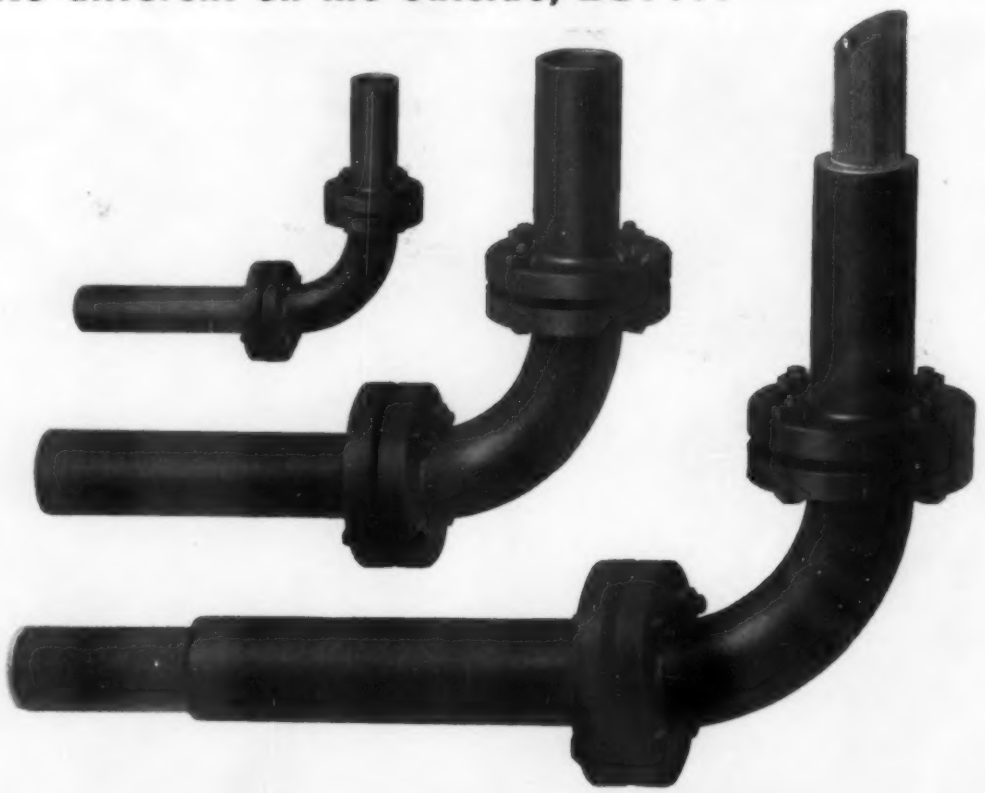

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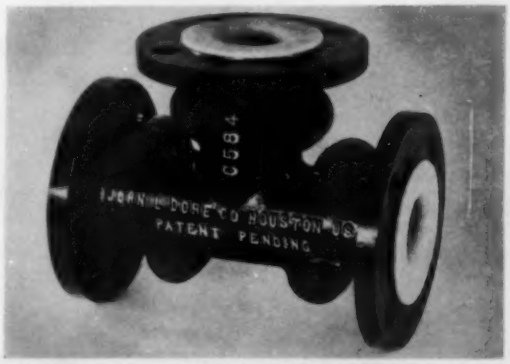

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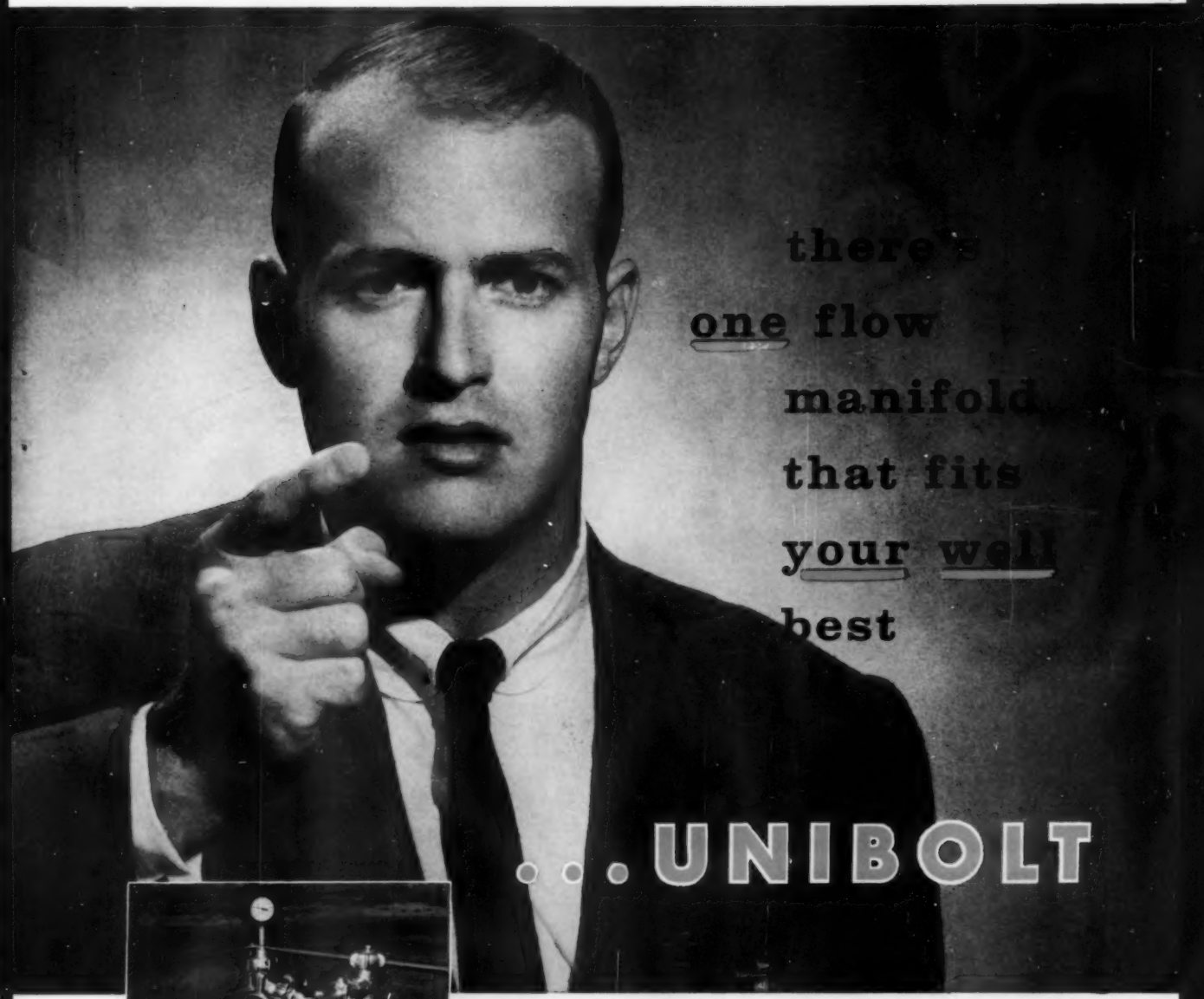

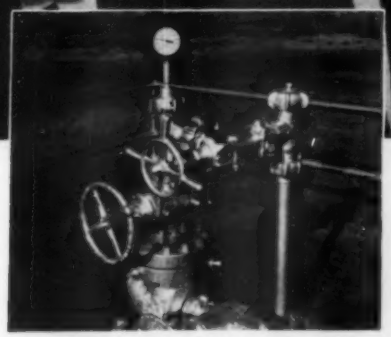

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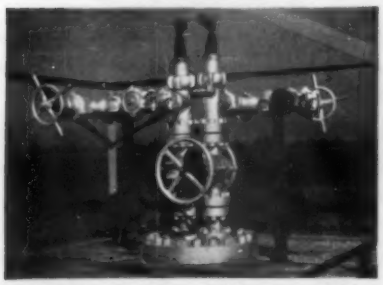

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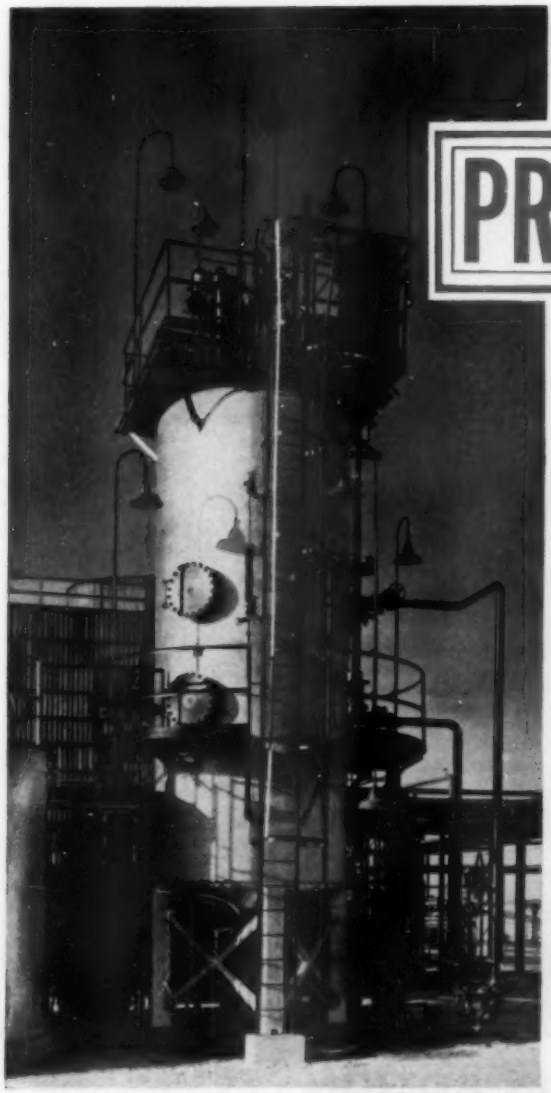

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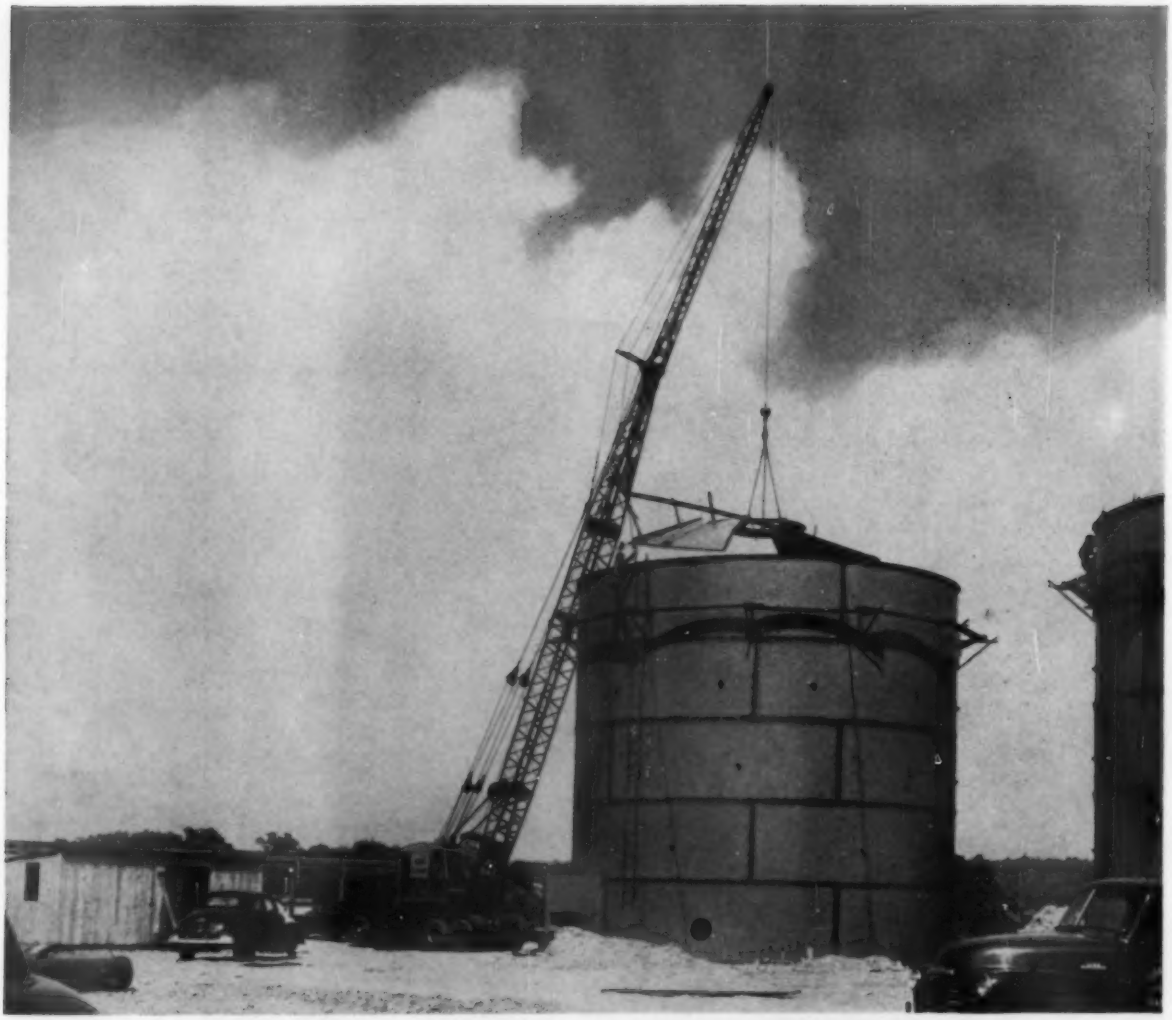

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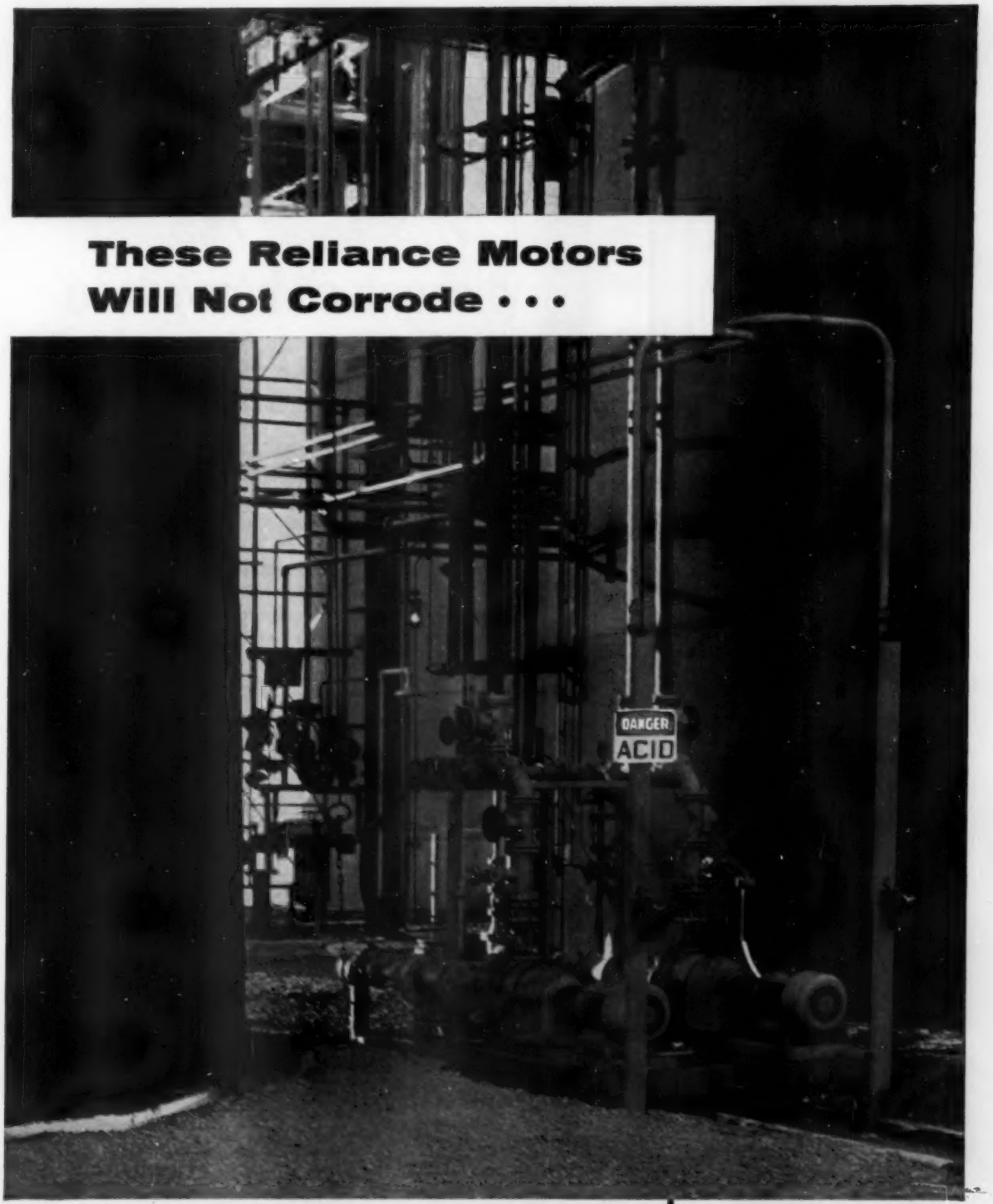

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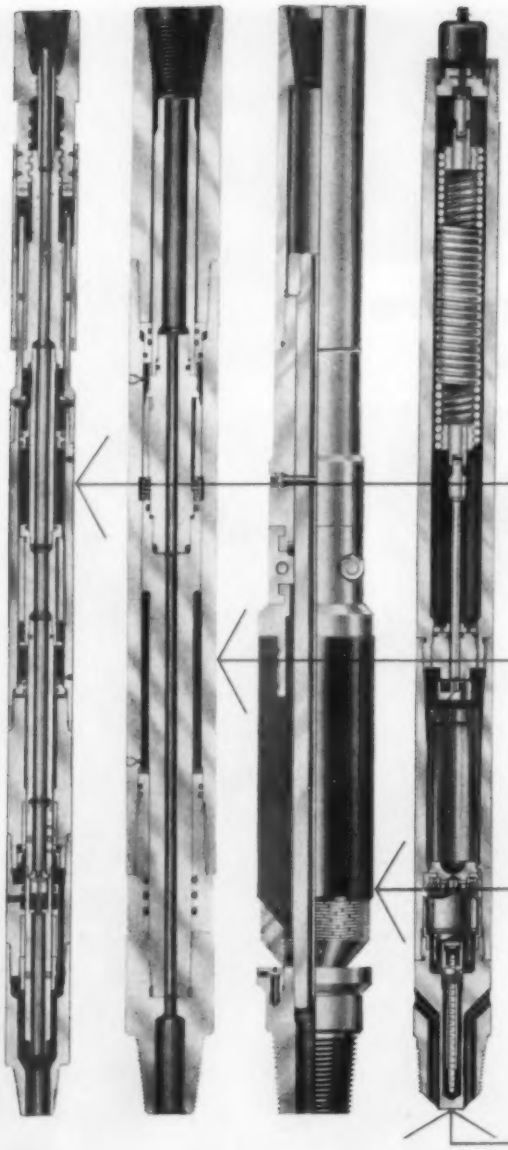

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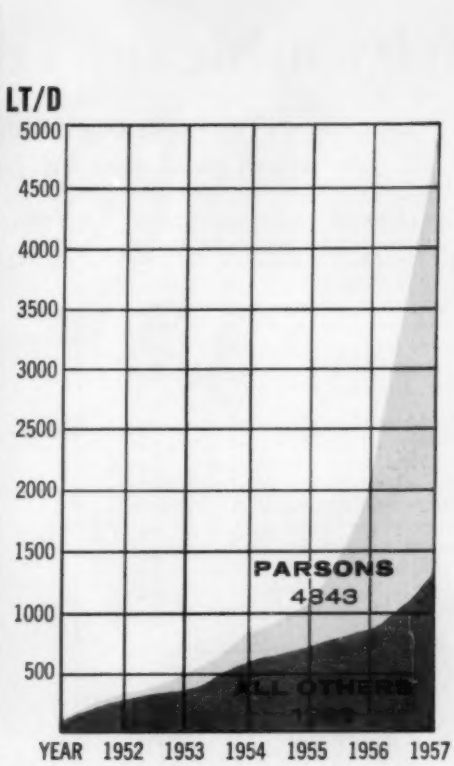

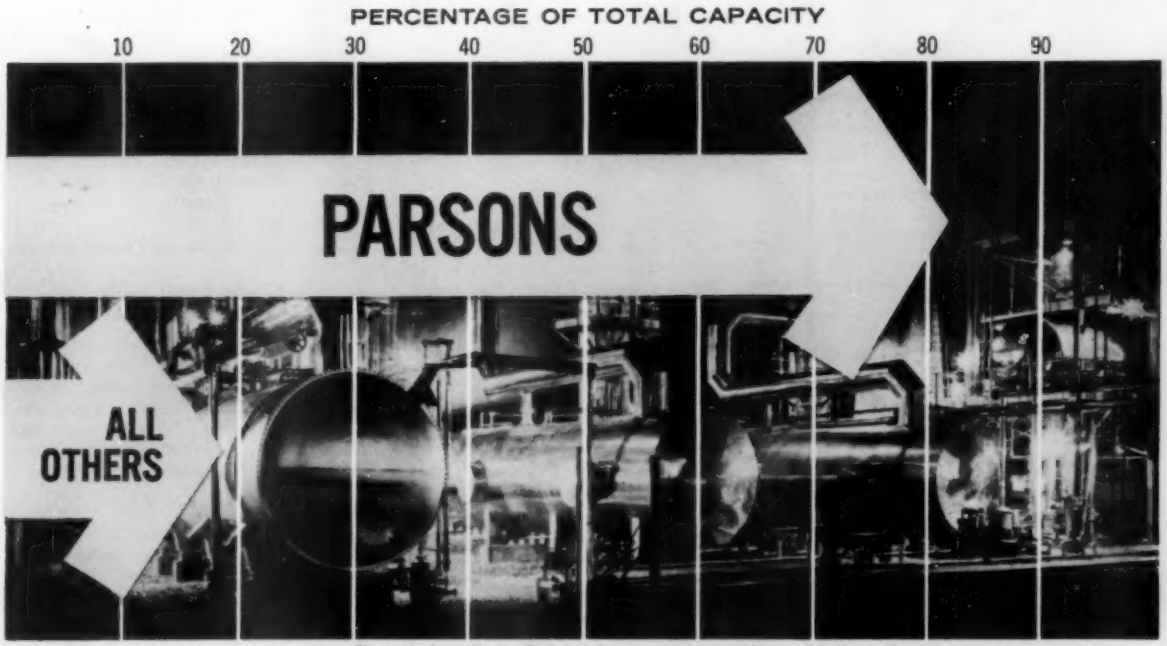

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Why a Steam Trap Has to Handle "Air"

Low temperatures and corrosion of equipment are often evidence of inadequate trap air venting capacity

Air, with its load of oxygen and carbon dioxide, has an unwholesome habit of interfering with the efficiency of steam heated units. If steam were always free of these undesirable companions, things would be a lot simpler for men-who-operate-plants. Because it isn't, three unhappy situations frequently occur:

1. ***Operating temperatures are subnormal.*** This is a two-part problem. First, an air-steam mixture has a lower temperature than pure steam at the same pressure—see Table A. Secondly, air can "plate out" on heat transfer surfaces as shown in Figure 1. Under some conditions, such an air film will knock down heat transfer efficiency by as much as 50%.

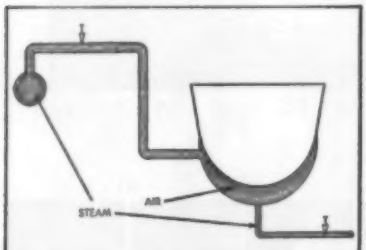


Fig. 1. *How air can "plate out" on heat transfer surfaces. This "insulation" drastically reduces heat transfer efficiency. Armstrong trap operation creates turbulence in the equipment that prevents this.*

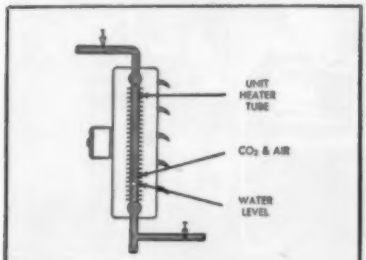


Fig. 2. *Corrosion occurs when units are not kept continuously free of both condensate and air. Armstrong traps discharge both,* at steam temperature, *as fast as they accumulate.*

2. ***Corrosion rears its ugly head.*** Oxygen and carbon dioxide are real trouble-makers. CO_2 gas goes into solution in condensate, forms carbonic acid and chews away at vulnerable metal sections. O_2 aggravates the situation. See Figure 2.

TABLE A—How air reduces steam temperature.

Gauge Pressure	Temp. of Steam with No Air Present	Temp. of Steam Mixed With Various Amounts of Air (% Air by Volume)	
		10%	30%
10.3	240.1	234.3	220.9
25.3	267.3	261.0	246.4
50.3	298.0	291.0	275.1
75.3	320.3	312.9	295.9
100.3	338.1	330.3	312.4

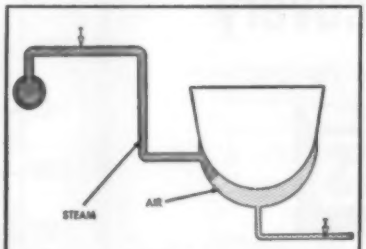


Fig. 3. *When steam is turned on, it takes a trap with extra air venting capacity to provide fast heat-up.*

3. ***Heat-up is slow as a snail.*** Air has a picnic in units that are shut off periodically. Figure 3 pictures the problem. Lines and equipment literally fill up with air. When the steam is turned on it can get in only as fast as the air gets out.

Enter Steam Traps

Curing these steam system ailments involves an operation sometimes called a "trap transplant." It consists of removing traps that don't get the air out and replacing them with traps that do.

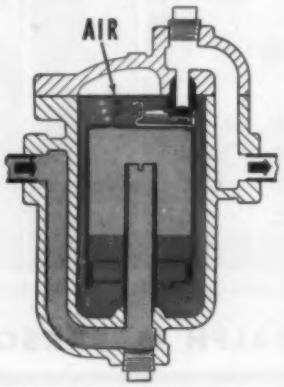
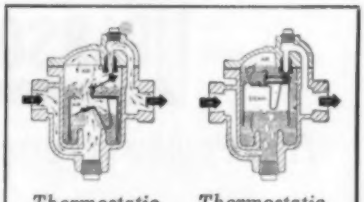


Fig. 4. *Air entering an Armstrong trap passes through the bucket vent and accumulates in the top of trap. When trap opens, air is discharged along with condensate.*

Figure 4 shows how an Armstrong inverted bucket trap continuously vents air. What the picture doesn't show is a built-in plus-value of this trap's design. An Armstrong trap opens suddenly, creating a momentary pressure drop and turbulence in the unit being drained. This breaks up air films and "pumps" air down to the trap so it can be vented.

The vents in standard Armstrong trap buckets will pass all the air normally encountered. In special cases, such as paper machine dryers, the vents are correctly sized larger at the factory to meet the requirement.



Thermostatic vent open. *Thermostatic vent closed.*

Fig. 5. *Open float with thermostatic vent for off-and-on units. When trap is cold, vent is open, permitting air to blow through when steam is turned on. When steam reaches trap, heat closes thermostatic vent. Then, regular bucket vent handles all air coming in with steam.*

Open Float with Thermostatic Vent

Super air-venting capacity is a must for fast heat-up of low pressure unit heaters, heating coils, steam headers and other units that are on-and-off. Figure 5 shows how the Armstrong open-float-with-thermostatic-vent trap takes care of this.

* * *

The 44-page Armstrong steam trap book covers other features of the Armstrong trap as well as its excellent air handling characteristics. This catalog also discusses trap selection, installation and maintenance. Your local Armstrong Representative or Distributor will be glad to give you a copy. Call him, or write Armstrong Machine Works, 8685 Maple Street, Three Rivers, Michigan.

ARMSTRONG STEAM TRAPS

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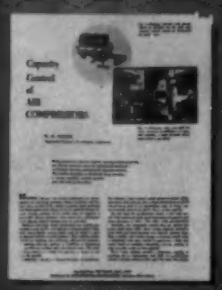

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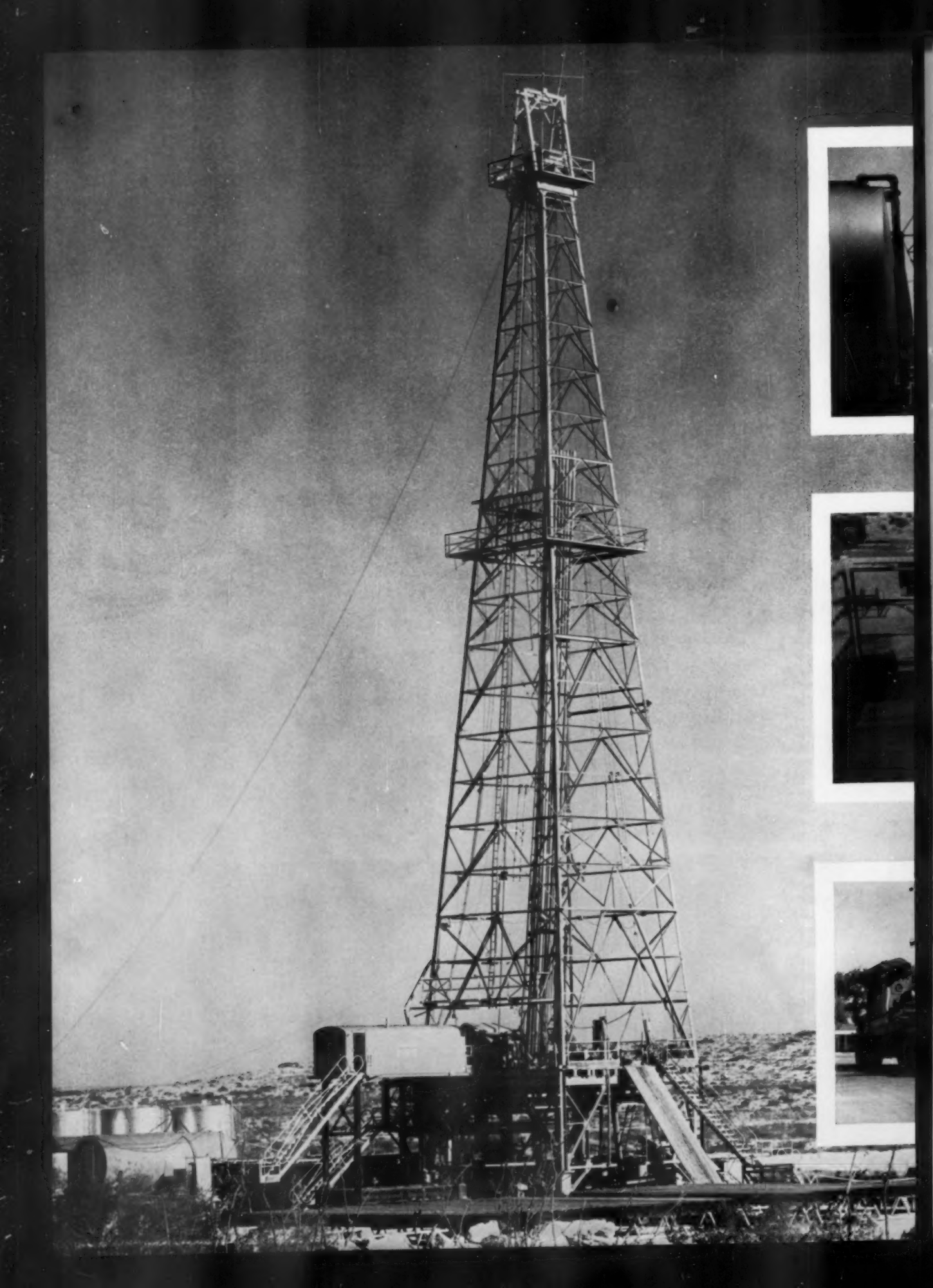
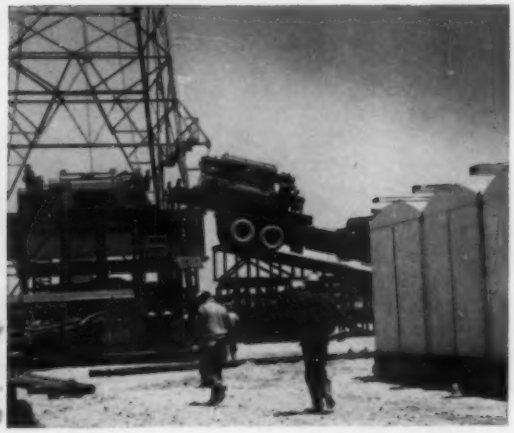


Great Western Drilling Company reports . . .

G-E Equipped Rig Drills 23,000 Feet in 364 Days!



RIG-UP TOOK ONLY 3 DAYS, including 125-mile move. Time-consuming mechanical alignment is eliminated with electric drive's flexible cable connections.

GW's Diesel-Electric Rig 44 Handles 600,000-pound Net Hook Load Setting Record 15,868 Feet of 9 5/8-inch Casing

POSITIVE, SIMPLE CONTROL enables GW drillers to drill more hole at less cost. G.E.'s low maintenance drive system reduces down-time to a bare minimum.

GREAT WESTERN'S G-E EQUIPPED RIG HAS SET RECORDS even before completion of one of the world's deepest holes. At Phillips Petroleum & Sinclair Oil Company's No. 1-A Montgomery in Pecos County, Texas, a record string of 15,868 feet of 9⅝-inch casing was recently set. To accomplish this, the rig handled a net hook load of 600,000 pounds, one of the heaviest known loads ever encountered.

ALMOST SIX MONTHS AHEAD OF THE ORIGINAL DRILLING SCHEDULE, Great Western has experienced no significant loss of time due to electrical failure or maintenance. The dependability of the General Electric Drive System has kept down-time to a bare minimum and its inherent advantages have enabled Great Western to drill more hole at less cost.

FOR MORE INFORMATION ABOUT GENERAL ELECTRIC DRIVE, call your nearest G-E Apparatus Sales Office. Drilling offices are located in Dallas, Denver, Houston, Los Angeles, New Orleans, and Tulsa; in Canada: Calgary and Toronto. For overseas requirements, International General Electric drilling offices are located in Bogota, Buenos Aires, Caracas, Maracaibo, Mexico City, New York, and Puerto LaCruz. General Electric Company, Locomotive and Car Equipment Department, Erie, Pennsylvania.

115-26

G-E DRIVE'S PORTABILITY is demonstrated by move time required from Odessa to Ft. Stockton—half that needed for comparable mechanical rig.

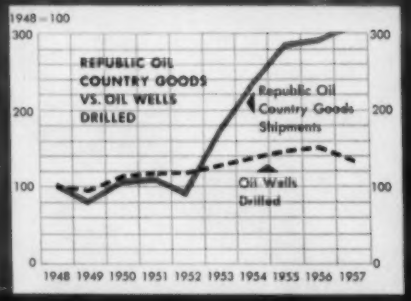
Progress Is Our Most Important Product

GENERAL ELECTRIC

REPUBLIC STEEL
FASTEST GROWING
MAJOR IN
CASING AND
TUBING

Republic is in this business all the way! Staffed with people who know the oil industry as well as they know steel. Backed by a half-century of experience in making top-quality tubular goods. Pioneer of the electric weld process. Now operating the most modern seamless mill. With a reputation for product uniformity and dependability that's unsurpassed in the industry. Major expansion program recently completed assures you that Republic brand tubular goods will always be in strong supply.

To meet your needs for oil country tubular goods, Republic has tripled Casing and Tubing production in the last ten years. Seamless and welded. J-40, H-55, N-80. On-schedule delivery from strategically located field stocks. Specify "Republic."



REPUBLIC STEEL

REPUBLIC STEEL

C. E. Williams, Gulf Sales Engineer, Midland, Texas, and G. W. Ramsey, Assistant Plant Superintendent, inspect force feed lubricators on one of the modern gas engines at the Goldsmith plant of El Paso Natural Gas Company.

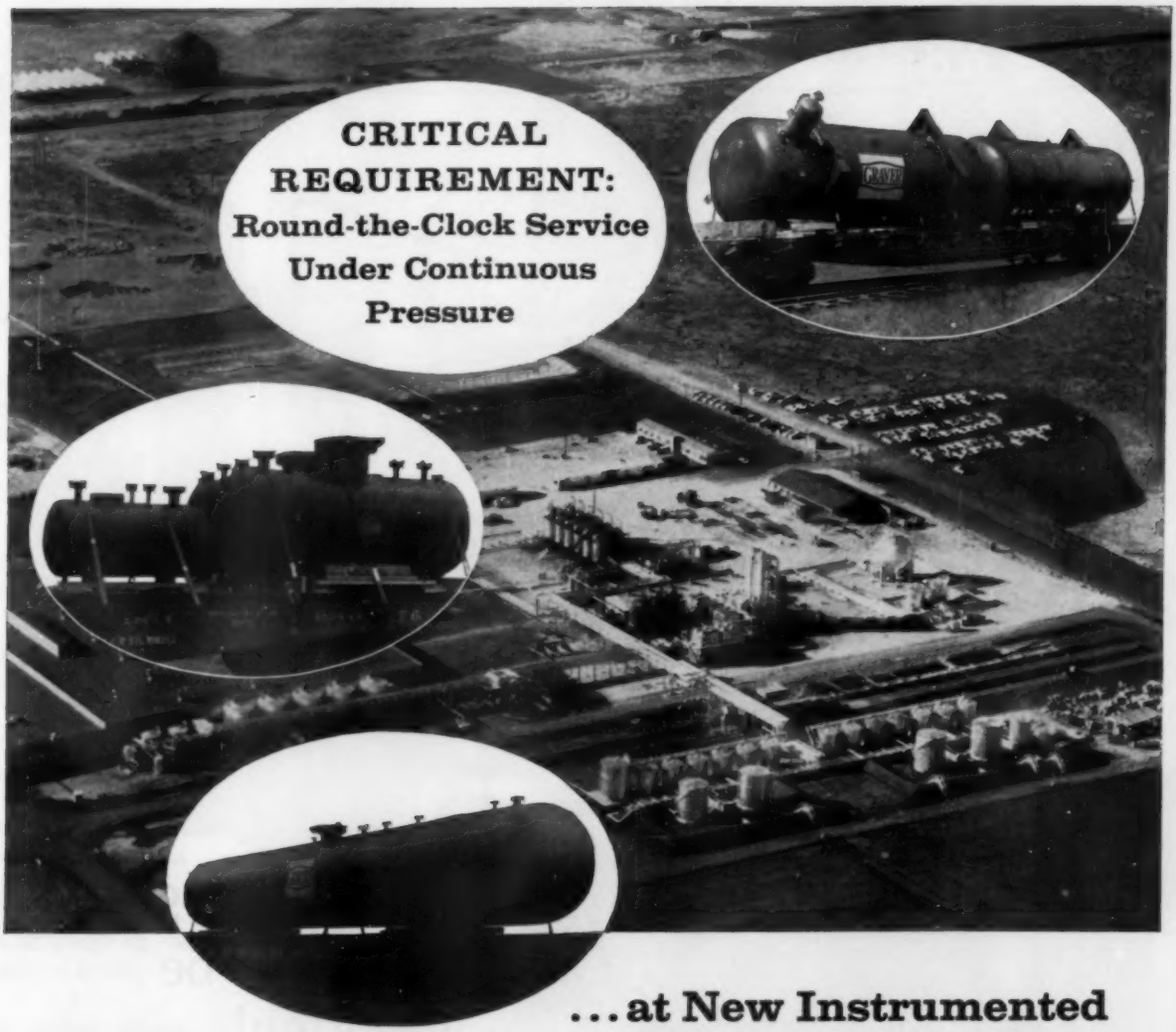
No lubrication problems in 8 years of operation

Since 1949, twenty-seven gas engine-compressor units developing 39,985 horsepower at the Goldsmith plant of El Paso Natural Gas Company have been thriving on Gulf Security Oil. Bearing, ring and cylinder wear maintenance records have been excellent.

Insure safe, more effective lubrication protection for *your* compressor units. Specify Gulf Security . . . the high quality, straight mineral oil. For full information, call your nearest Gulf office.

GULF

GULF OIL CORPORATION, Dept. DM, Gulf Building, Pittsburgh 30, Pa.



...at New Instrumented

GENERAL TIRE Synthetic Rubber Plant at Odessa

The nation's first privately financed and first completely integrated synthetic rubber operation owned jointly by The General Tire & Rubber Company and The El Paso Natural Gas Company at Odessa, Texas utilizes 880 instruments for absolute and continuous control by a single operator.

Just 22 months after the agreement was signed between The General Tire & Rubber Company and The El Paso Natural Gas Company, two new plants costing $32,000,000 went on stream at Odessa, Texas to manufacture GR-S synthetic rubber. Now in full production day and night, a continuous stream of raw materials enters the General Tire plant at one end, leaving the other end as bales of synthetic rubber. The entire manufacturing process demands the utmost care in the control of timing, temperatures, pressures and the proportionate quantities of the various ingredients.

Eighteen pressure vessels fabricated by Graver of ASTM A-285 Grade C flange quality steel are important links in the modern automation chain at the General Tire plant. Built to be in operation around-the-clock under continuous pressure, the 18 pressure vessels are symbolic of the meticulous fabricating craftsmanship Graver applies to processing equipment for the petrochemical, chemical and petroleum industries. Over a century of experience qualifies Graver to tackle the most exacting specifications.

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Building for the Future on a Century of Craftsmanship in Steels and Alloys

GRAVER TANK & MFG. CO., INC.
EAST CHICAGO, INDIANA • New York • Philadelphia
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ALLEN-BRADLEY | Cutting Costs in the Chemical Industry

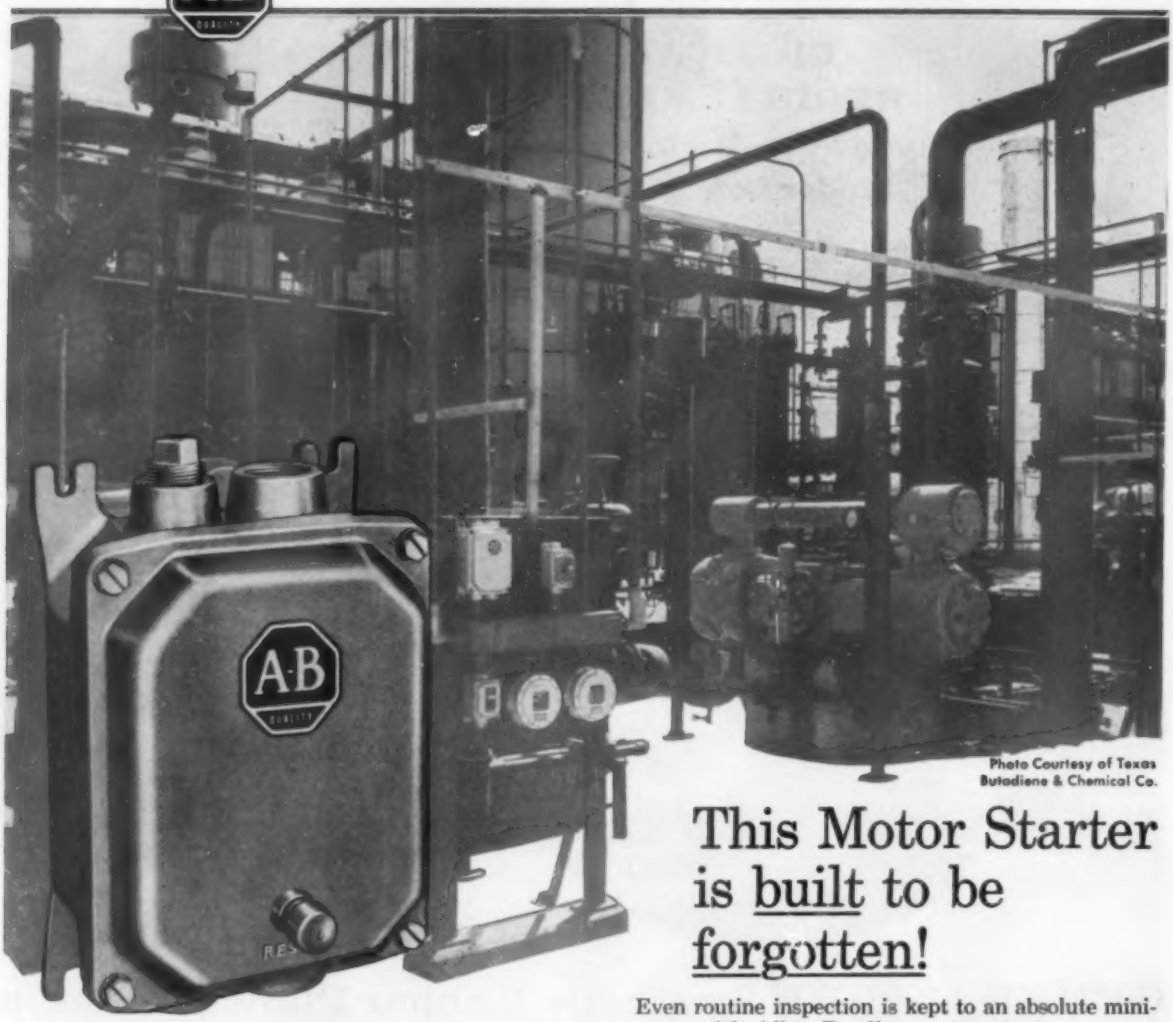
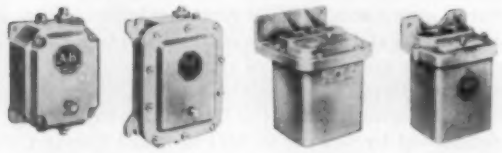


Photo Courtesy of Texas Butadiene & Chemical Co.

This Motor Starter is built to be forgotten!

Bulletin 709 Size 1 Solenoid Starter in NEMA Type 4 watertight enclosure



NEMA 9 For Hazardous Dust | NEMA 7 For Hazardous Gas Locations | NEMA 8 For Corrosive Hazardous Gas | NEMA 11 Corrosion-proof

Allen-Bradley Bulletin 709 across-the-line solenoid starters are made in eight sizes with maximum ratings to 300 hp, 220 volts; 600 hp, 440-550 volts.

Even routine inspection is kept to an absolute minimum with Allen-Bradley motor starters . . . an especially important saving when your installation requires bolted covers, as used with watertight and explosion-proof enclosures.

It's the simple contact mechanism—with only ONE moving part—that enables Allen-Bradley solenoid starters to operate over long periods without attention. With no bearings to corrode or stick . . . no flexible jumpers to break . . . you are assured *millions* of trouble free operations. In addition, there are double break, silver alloy contacts that never need servicing of any kind. And permanently accurate thermal overload relays protect motors against burnout, irrespective of time or atmospheric conditions.

Specify Allen-Bradley quality controls for *all* your installations . . . and you'll save on maintenance.

ALLEN-BRADLEY CO.
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1304 S. Second St.
Milwaukee 4, Wis.

In Canada: Allen-Bradley Canada Ltd.
Galt, Ont.

THE TEST OF ANY PUMP

IS IN PERFORMANCE. AND IT IS IN PERFORMANCE THAT GASOS HAVE WON THEIR PLACE AS THE NO. 1 CHOICE OF PIPELINE MEN THE WORLD OVER

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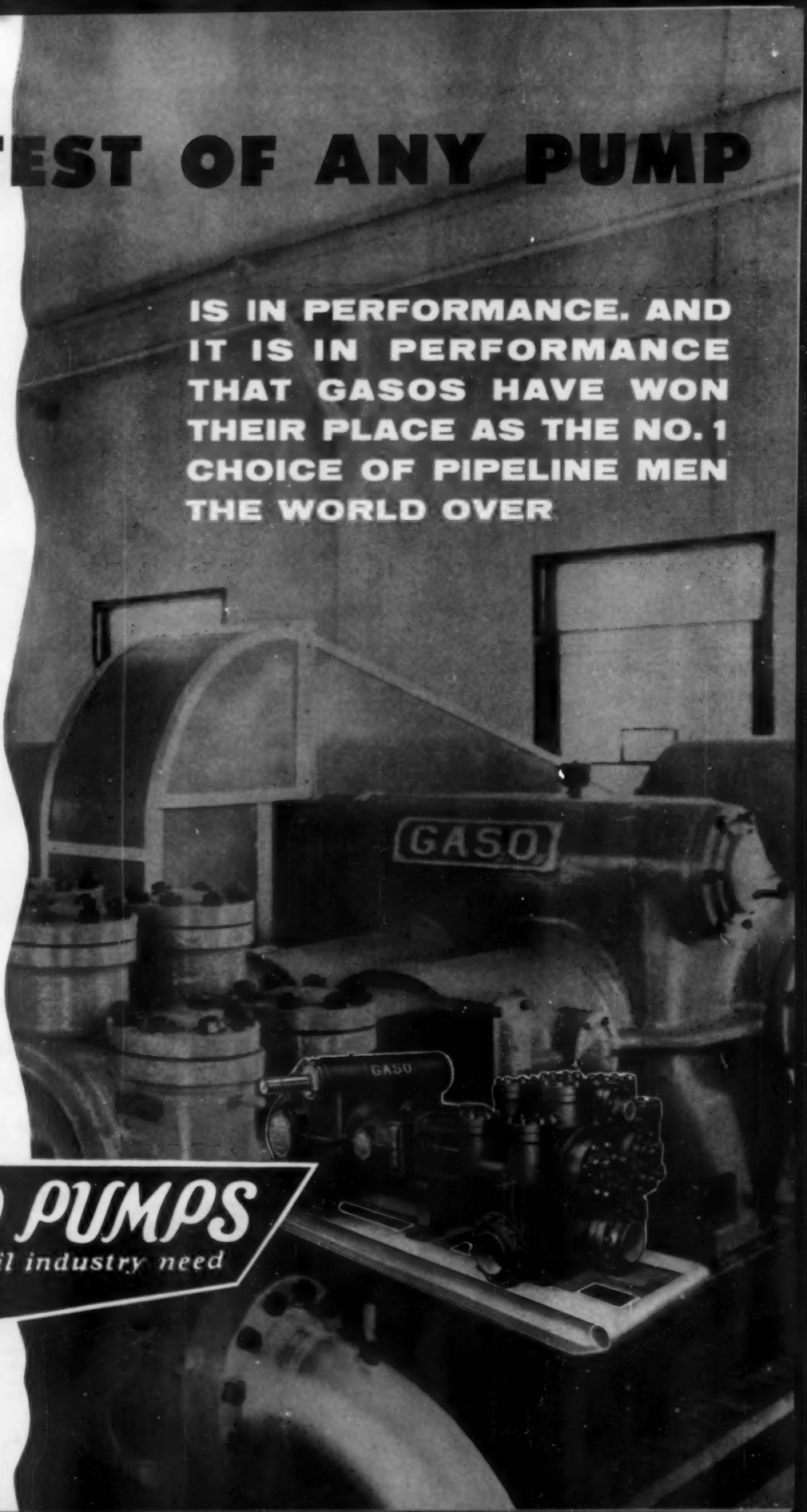

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for every oil industry need

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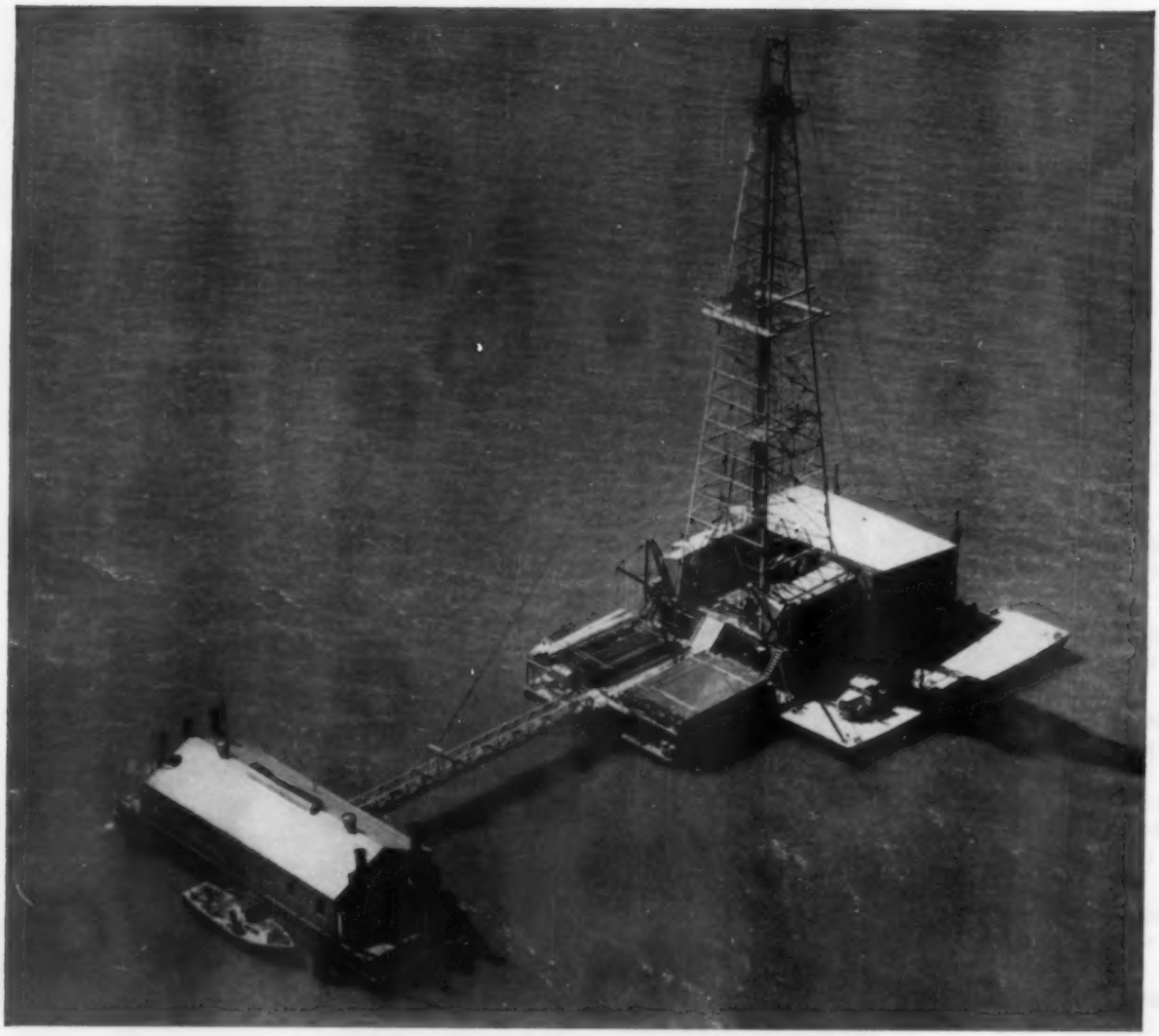

NOW IS THE TIME...stock up on **Roebling Royal Blue Wire Rope**...the dollars you spend today **guarantee tomorrow's profit.** There's never been a tougher, longer-lived wire rope than **Royal Blue.** It has been tested in the laboratory and proved in the field for operational permanence. On these facts alone, you can be sure that every dollar you spend for **Royal Blue** will go further. You will be able to count your profit later. Try **Royal Blue now**—find out for yourself.

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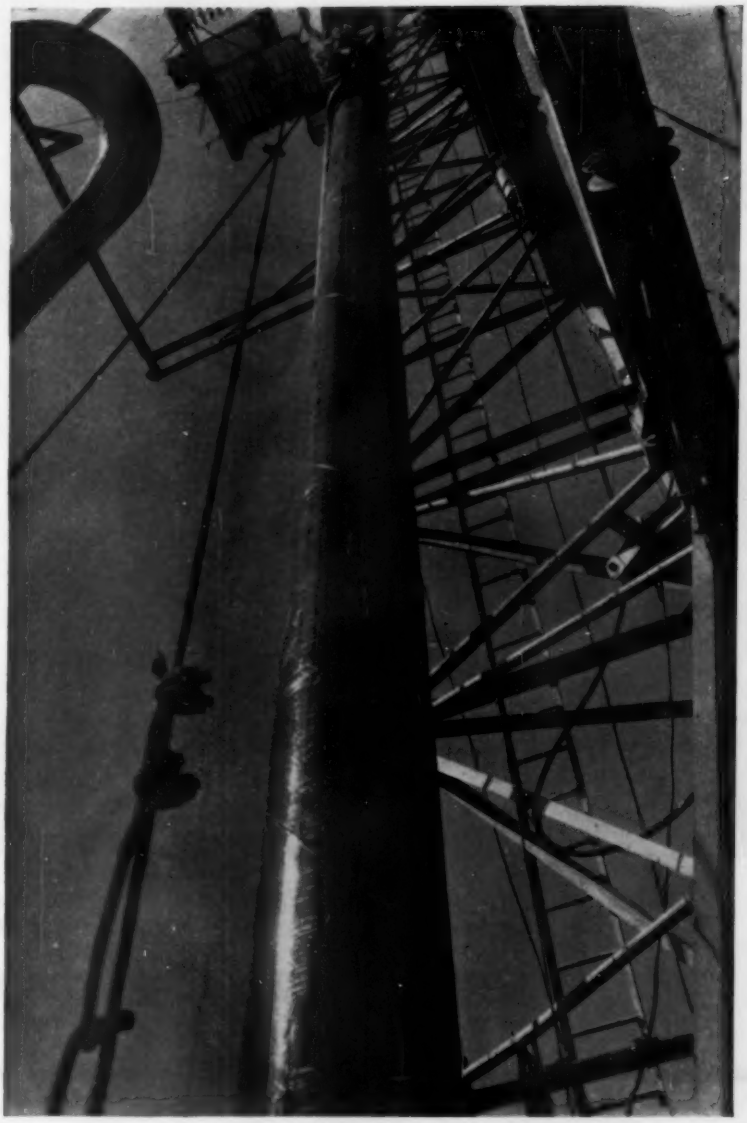
DESIGN
FOR WIRE ROPE
its ready adaptability is evident wherever power is transmitted. It conforms to unique design requirements. Use wire rope to transmit power.

Armco Casing Cuts Costs 3 Ways

Engineers and drilling contractors have found that Armco Slip-Joint Casing gives them definite advantages and economies. Here are three reasons why Armco Casing means lower costs, greater efficiency, and faster running.



FIELD WELDING COSTS LOW

Just stab one end of a 40- or 50-foot joint into the Armco Slip-Joint Collar, make a fast weld, and lower away. The downhand fillet weld required is the fastest and easiest to make. Field welding costs stay down.

CASING COSTS LOW

The uniformly high collapse resistance of Armco Casing lets operators safely set lighter, lower cost strings to greater depths. Carefully conducted tests show that the variation in collapse pressure for Armco Casing is less than for other types of casing.

LESS RUNNING TIME

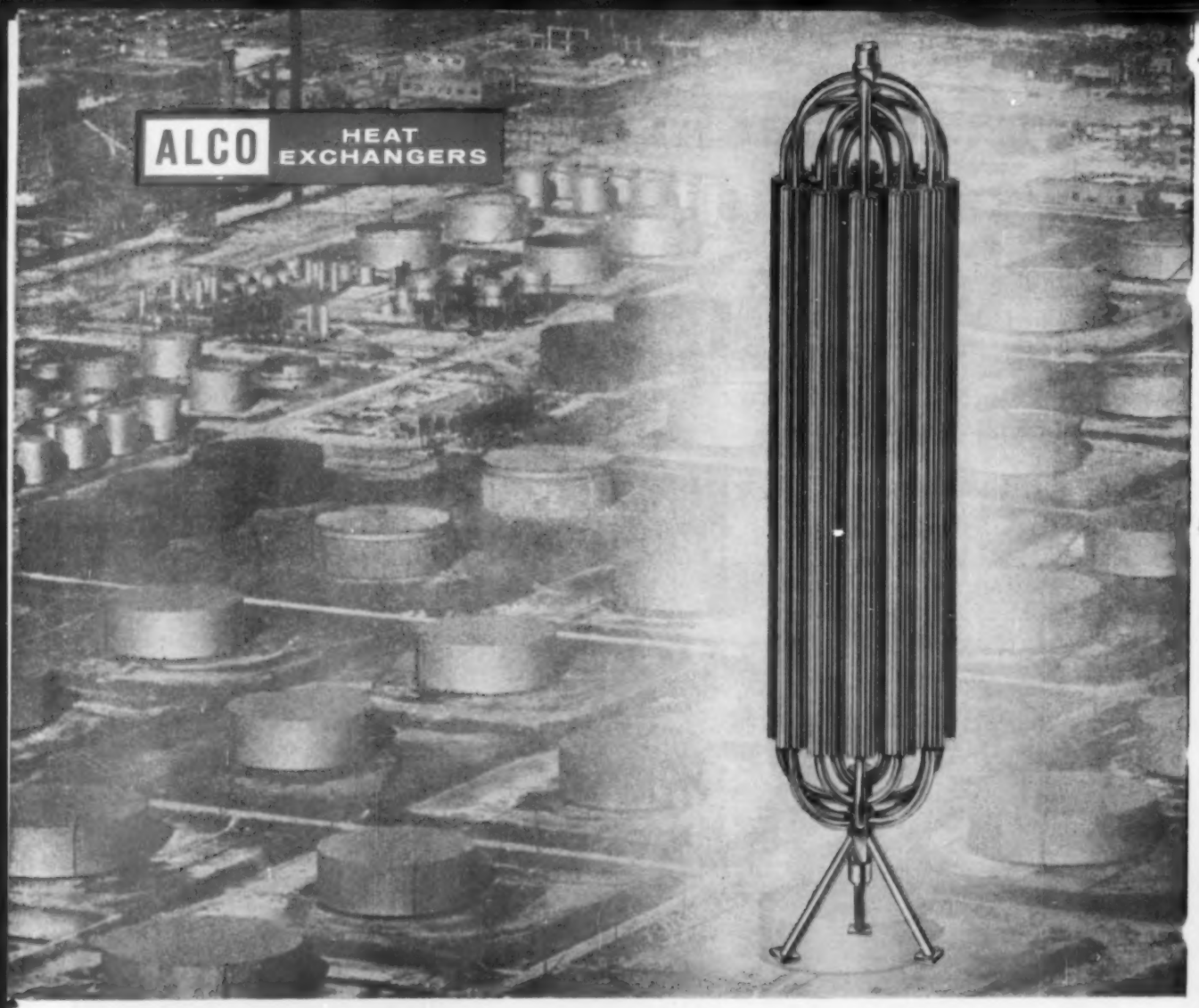
Fewer joints in the string mean faster running, lower costs. Armco Casing is supplied in exact 40- or 50-foot lengths instead of the usual random or double-random lengths. Uniform lengths help you quickly determine the footage in the hole or in the stockpile at any time.

Armco Casing is distributed by National Tank Company from 21 stocking points throughout the oil country. Sizes range from 6 to 24 inches. When you have a rush job, a call to the nearest stock point listed below will start the casing on the way. Write to us for more data. Armco Drainage & Metal Products, Inc., 3848 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

ARMCO SLIP-JOINT CASING

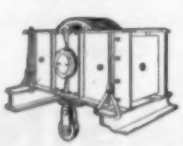
Distributed by National Tank Company, Tulsa, Oklahoma. In Canada: National Tank Company, Ltd., Edmonton, Alberta

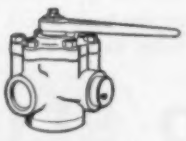
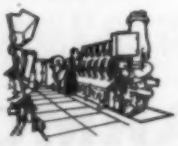
National Tank Company Stocking Points for Armco Casing: Williston, North Dakota; Sidney, Nebraska; Brush, Colorado; Great Bend, Kansas; Liberal, Kansas; Oklahoma City, Oklahoma; Seminole, Oklahoma; Farmington, New Mexico; Hobbs, New Mexico; Pampa, Texas; Lubbock, Texas; Snyder, Texas; Abilene, Texas; Odessa, Texas; Houston, Texas; Shreveport, Louisiana; Lake Charles, Louisiana; New Iberia, Louisiana; Harvey, Louisiana; Clay City, Illinois; New Harmony, Indiana



ALCOHEATER'S *fin tubes provide high rate of heating for easier transport of viscous fluids. Design promotes thermal circulation. Unit can be passed through standard manhole for easy installation.*

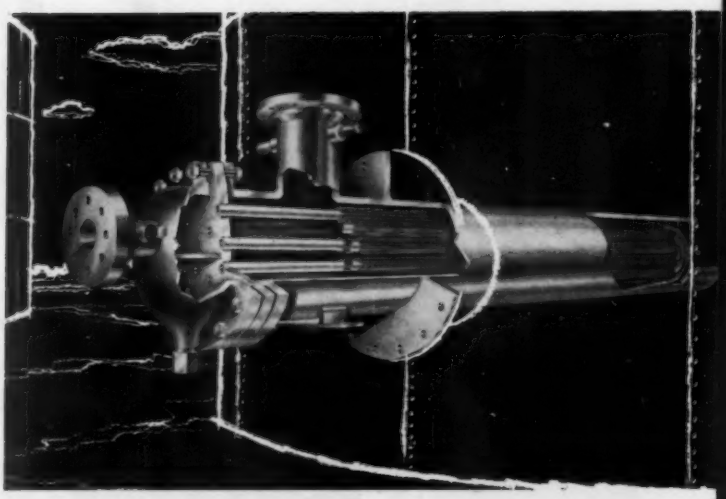
ONLY NEW ALCO FINNED TUBES



Crown and travelling blocks • *Oil-field valves* • *Wellhead equipment* • *Kinney plug injectors* • *Diesel-electric power package*

ALCO's *new welding process allows wide range of fin and tube metallurgy. Recent installation combined copper fins with Admiralty tubes.*



Tank suction heater by ALCO *uses fin tubes for straight-line heating with minimum pressure drop. Cool fin surfaces resist coking or fouling.*

MEET ALL PROCESS CONDITIONS

Using a new welding method, ALCO is producing integral fin tubes that have a higher heat-transfer efficiency. Longitudinal fins are welded to the tubes with a positive metal-to-metal union throughout their entire length. There are no spaces between fin and tube to lower heat transfer, and complete contact is assured throughout thousands of heating and cooling cycles.

ALCO is now using these improved fin tubes in exchangers like the ALCOTWIN®, ALCOHEATER and tank suction heater. The high heat-transfer rate, greater surface area, and resistance to coking or fouling combine to make these units highly efficient, flexible and easy to maintain.

The new integral fin tube is manufactured in a wide range of metallurgies for your process requirements. Complete information is available from any ALCO sales office, or write Petroleum Industry Equipment Division, Dept. 182, Bank of the Southwest Building, Houston, Tex.

ALCO

ALCO PRODUCTS, INC.
Petroleum Industry Equipment Division
HOUSTON

NEW VALVE-OLOGY

shuts off costly maintenance

Hancock 600# Steel Valves incorporate new concepts in valve-ology that reduce valve maintenance and equipment down-time. The forged steel bonnet and body have butting flanges so strong no distortion is possible. The flanges form a bonnet joint that utilizes the sealing power of a Flexitallic* gasket so effectively not even pressures exceeding ten times the rating of the valve can cause a blowout.

Hancock valve-ology makes full use of stainless steel to reduce your valving cost. Seat, disc, stem, swing bolts and nuts, thread bushing, packing gland follower—all are stainless steel. Globe, Angle, "Flocontrol", Lift Check, and Hi-Pressure Drop designs available. A high degree of standardization simplifies servicing and inventory needs. Your industrial supply distributor will gladly give you full details on Hancock Valve quality and performance. Phone him today.

Hancock 600# Steel Globe Valve. Type 5500 Line. Sizes: ¼" thru 2".

*Trademark of Flexitallic Gasket Company

MAXWELL MANNING M&M & MOORE INC. TRADE MARK

H2-58

HANCOCK STEEL VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Watertown, Massachusetts
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GUTS!

no other pipe insulation stands up like **tough UNIBESTOS** to save replacement and maintenance costs

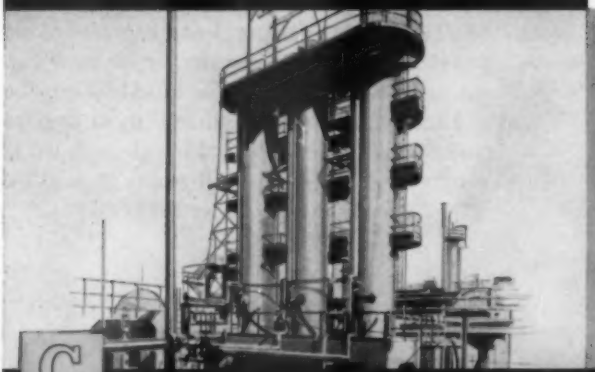
UNIBESTOS® won't shatter from hammer blows . . . is undamaged by fumes, water, or moisture . . . yet cuts and fits easily – goes on quickly – may be removed and reused time after time without damage or loss of efficiency. Sizes to 44" o.d.; single-layer thicknesses to 5". The whole cost-cutting story is yours for the asking. There's only *one* UNIBESTOS!

Somewhere on these pages is a

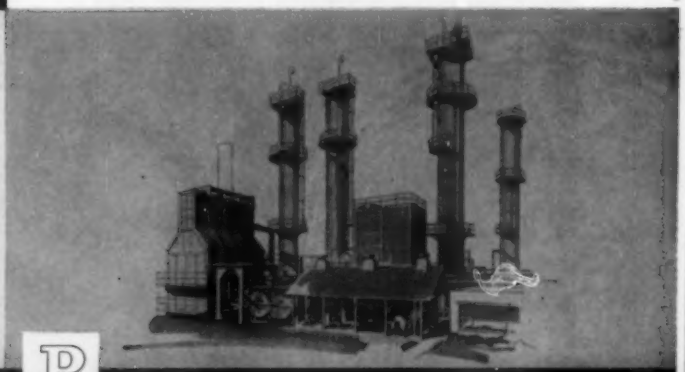
UOP

answer to most every petroleum processing problem.

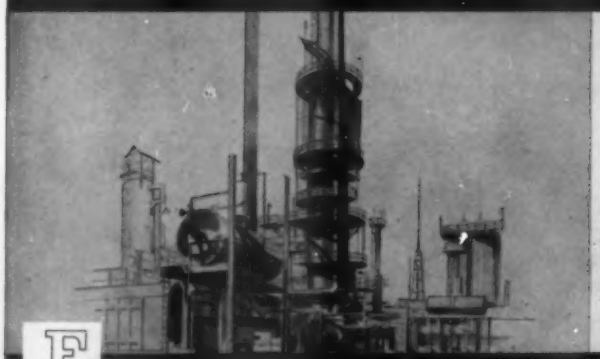
Working out the solution to a processing problem can be a pretty tough assignment for any refiner. But this is a UOP specialty and it's highly probable that UOP can come up with the right answer. Perhaps, we don't have all the answers right on tap but our more than 40 years of research and engineering development in oil refining technology is pretty good assurance that we can work them out. Quite possibly you will find



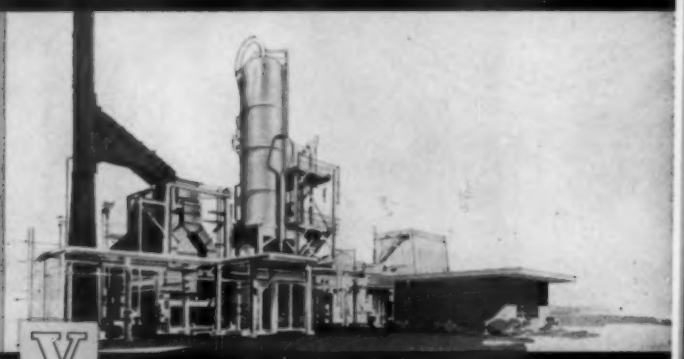
Catalytic polymerization A process for converting propylene and butylenes to high grade gasolines



Penex® The first practical process for upgrading pentane and hexane fractions

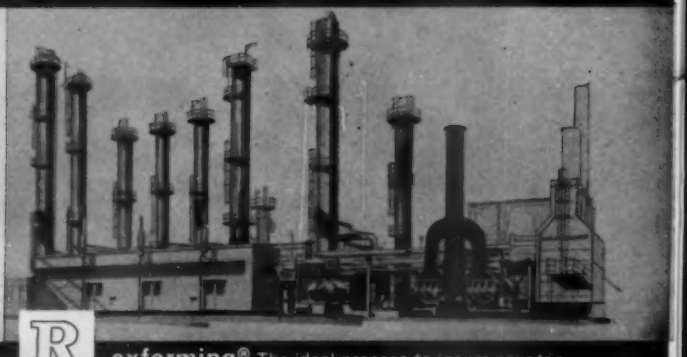


Fluid catalytic cracking Improved heavy oil conversion process for higher yields and octane numbers



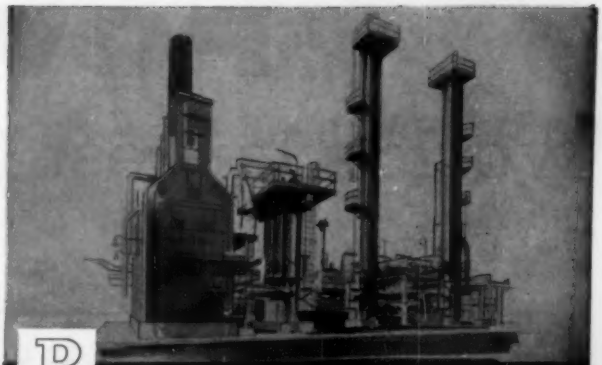
Vacuum distillation and visbreaking Efficient, economical processes for feed preparation

Low pressure coking A process that adds market flexibility

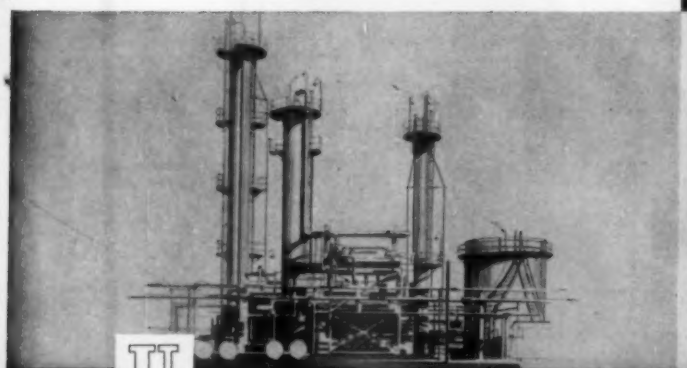


Rexforming® The ideal process to insure your top octane position

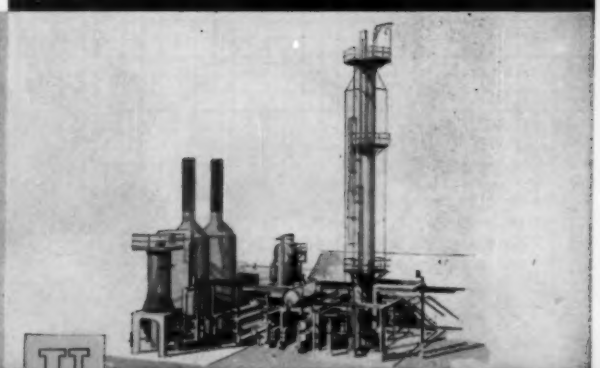
the solution among the processes shown here. For these represent only some of the refining and petrochemical processes UOP makes available to all refiners, anywhere. If you would like to know more about all the refining and petrochemical processes available from UOP we'll be glad to send you our handsome new 36 page brochure describing these more fully. Just drop us a line on your company letterhead.



P latforming® The most popular process for upgrading gasolines

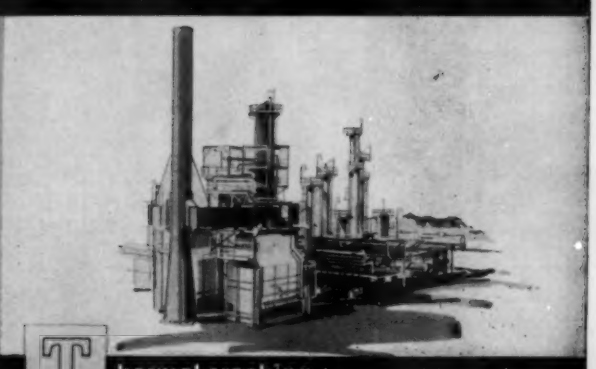


U nisol® A finishing process without octane degradation

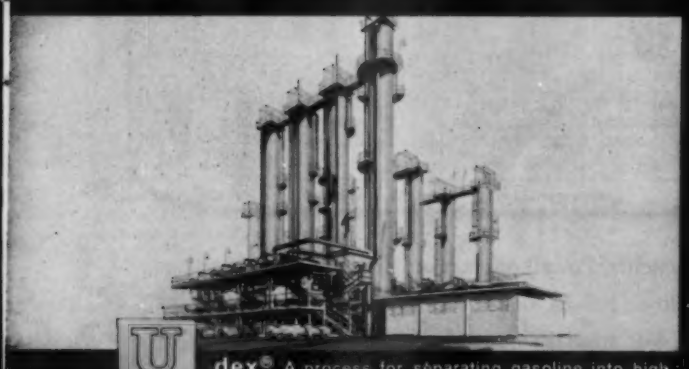


U nifining® A modern process for completely purifying petroleum distillates

HF Alkylation A catalytic process for producing alkylate



T hermal cracking An improved design of a basic refining process



U dex® A process for separating gasoline into high and low octane fractions

UOP UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road,
Des Plaines, Illinois, U.S.A.

MORE THAN FORTY YEARS OF LEADERSHIP IN PETROLEUM REFINING TECHNOLOGY

®Trademark

POWELL

world's largest family of valves

Fig. 512—Small Bronze Gate Valve for 150 pounds W.S.P. Inside screw non-rising stem. Solid wedge disc. Can also be supplied with flanged ends.

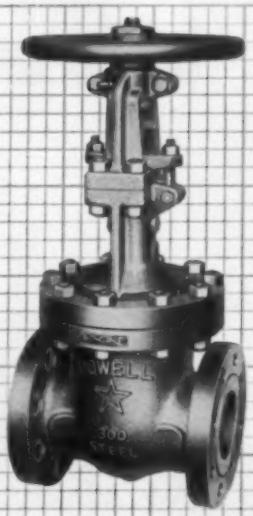


Fig. 3003—Steel Gate Valve for 300 pounds W.S.P. Outside screw rising stem and yoke. Solid wedge Disc, screwed-in seat rings. These valves also available for 150 pounds and higher pressures.

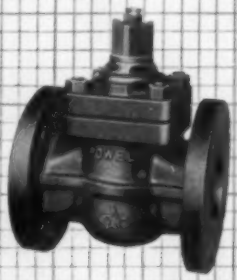


Fig. 2201—Semi-steel Lubricated Plug Valve for 175 pounds W.O.G. Single gland type. Sizes 1" to 4". Can be supplied with screwed ends. Other types and higher pressure valves are available.

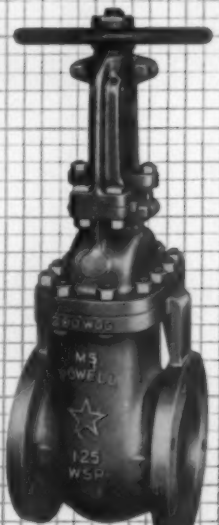


Fig. 1793—Large Iron Body Bronze Mounted Gate Valve for 125 pounds W.S.P. Outside screw rising stem and yoke. Solid wedge disc.

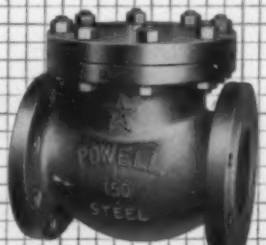


Fig. 1561A—New Steel Swing Check Valve for 150 pounds W.S.P. When disc is in wide open position straight, unobstructed flow area through the valve is provided.

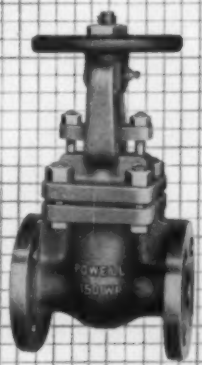


Fig. 2491—Small Stainless Steel Gate Valve for 150 pounds W.P. Outside screw rising stem and yoke, solid wedge disc. Can be supplied with interchangeable double wedge discs. Available also with screwed ends.

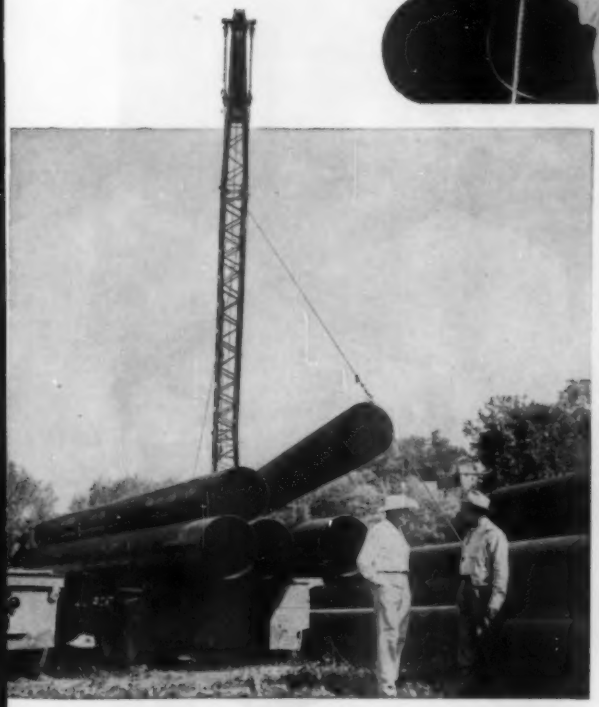
NO MATTER WHAT your flow control requirements, Powell offers more kinds or types of valves, available in the largest variety of metals and alloys. Powell distributors, located in all principal cities, maintain inventories to fill almost any need. For special engineering problems, write direct to:

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**

Lower away with USS Tiger Brand Rope—

and lower your costs

Stringing 30-inch pipe on the Texas Eastern line near Waynesburg, Pa. General Contractor: Williams Bros.; Stringing Contractor: Parkhill Truck Co., both of Tulsa.



Loading pipe with a crane rigged with USS American Tiger Brand Wire Rope and Sling. Ray Herron (left) of Parkhill and Charley Pool, who sold the rope.

THESE BIG 30-inch pipe sections weigh 3 to 4 tons each and they put plenty of strain on the wire rope. Operating conditions are severe. To get the longest service out of the wire rope, Parkhill Truck Company of Tulsa used American Tiger Brand 6 x 19 Monitor Excellay with Independent Wire Rope Core.

This rope is a favorite for rough service on all kinds of pipeline jobs. It is tough and strong—can take it when the going gets hard. Use it regularly and you'll save money on wire rope.

Tiger Brand Wire Rope is carried in stock by leading distributors wherever you go. Ask for it by name. American Steel & Wire, Rockefeller Building, Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks

American Steel & Wire Division of USS United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

Southwest Designs, Engineers, Plants Using the

and Builds Packaged Compressor
Compressor You Select

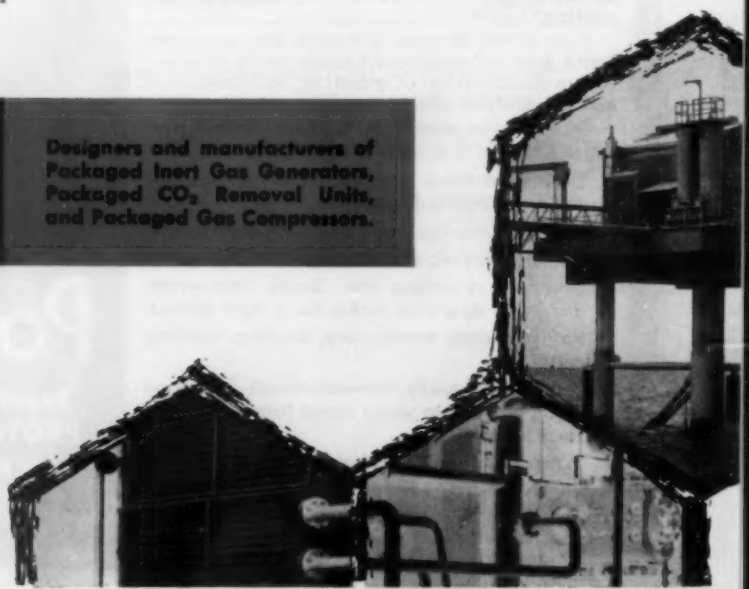
Now to the advantages of Southwest design and engineering you can add flexibility of choice by selecting your own make and type compressor in sizes of 100 to 880 hp. You have the sound advantages of proved Southwest engineering. There is no increase in your parts inventory. There is no training period to familiarize your personnel with a new make compressor. Yet, you can have the vastly improved and superior Southwest design for your packaged gas compressor.

Southwest Packaged Gas Compressor Plants installed in the field are now producing more than 100,000 horsepower—compressing more than 1½ billion CF/D—for field pressure boosting, main line gas pipe line pumping, secondary recovery, and other difficult applications.

SOUTHWEST INDUSTRIES, INC.

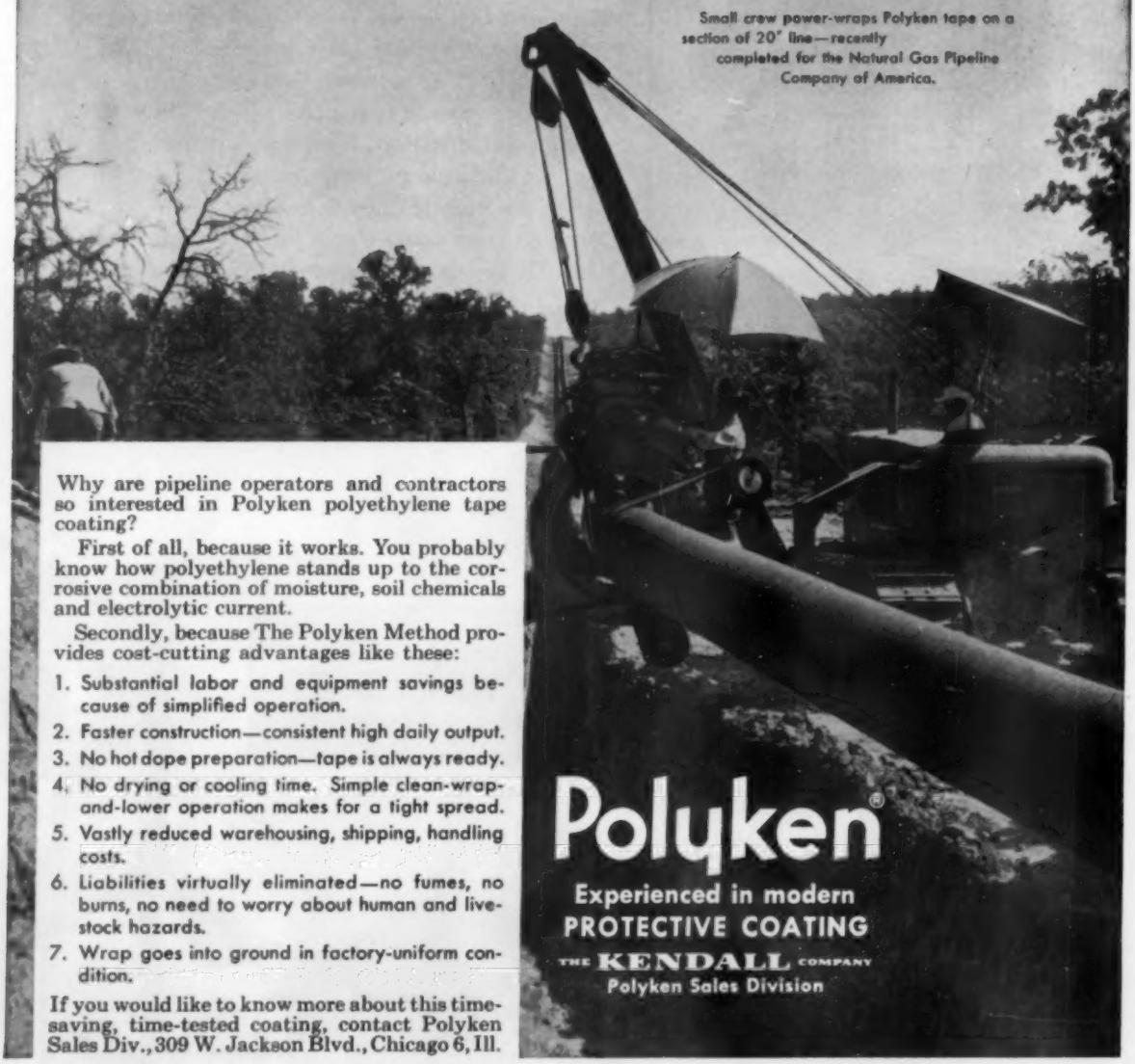
P. O. Box 19392, Houston 24, Texas

Designers and manufacturers of Packaged Inert Gas Generators, Packaged CO_2 Removal Units, and Packaged Gas Compressors.



Big-Inch pipeline wrapped the modern way

Polyken Tape saves time, labor and handling costs, yet resists corrosive attack as only polyethylene can



Small crew power-wraps Polyken tape on a section of 20" line—recently completed for the Natural Gas Pipeline Company of America.

Why are pipeline operators and contractors so interested in Polyken polyethylene tape coating?

First of all, because it works. You probably know how polyethylene stands up to the corrosive combination of moisture, soil chemicals and electrolytic current.

Secondly, because The Polyken Method provides cost-cutting advantages like these:

1. Substantial labor and equipment savings because of simplified operation.
2. Faster construction—consistent high daily output.
3. No hot dope preparation—tape is always ready.
4. No drying or cooling time. Simple clean-wrap-and-lower operation makes for a tight spread.
5. Vastly reduced warehousing, shipping, handling costs.
6. Liabilities virtually eliminated—no fumes, no burns, no need to worry about human and livestock hazards.
7. Wrap goes into ground in factory-uniform condition.

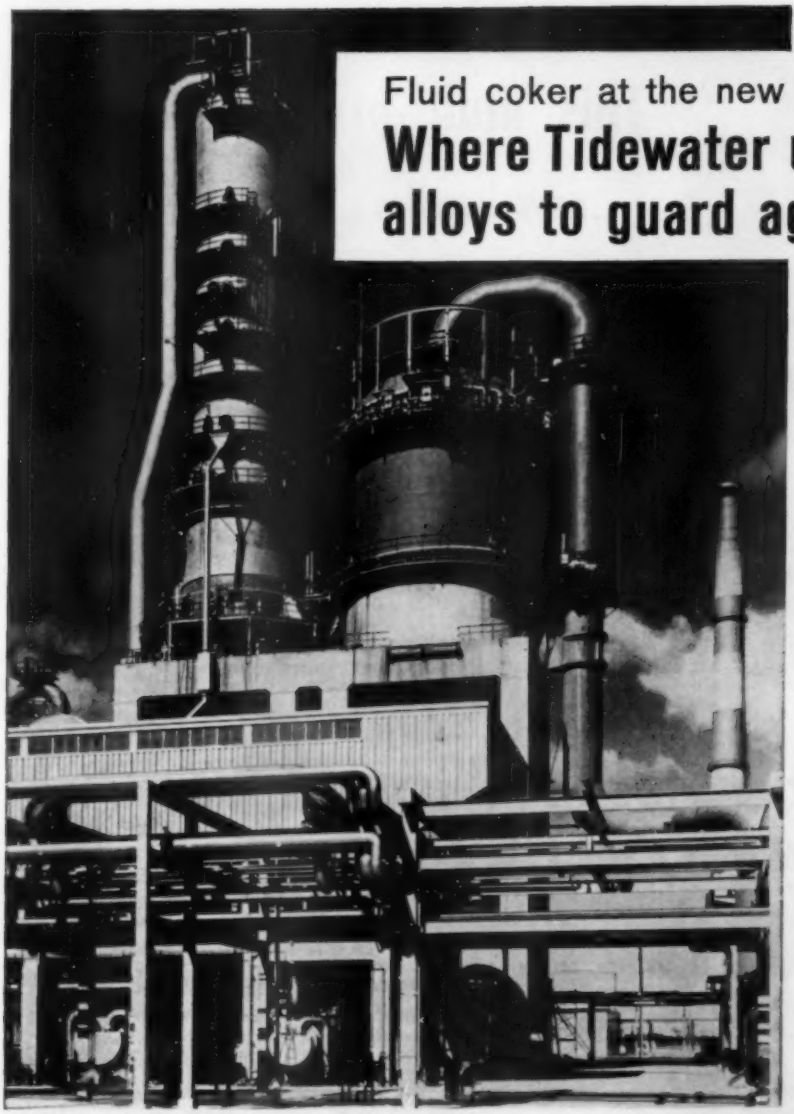
If you would like to know more about this time-saving, time-tested coating, contact Polyken Sales Div., 309 W. Jackson Blvd., Chicago 6, Ill.

Polyken®

Experienced in modern PROTECTIVE COATING

THE KENDALL COMPANY

Polyken Sales Division



Fluid coker at the new Delaware Refinery...

Where Tidewater uses high nickel alloys to guard against corrosion

Here's the fluid coker at the Tidewater Oil Company's new Delaware Refinery, which boasts the world's largest initial capacity.

Like other units in this refinery, the fluid coker reflects latest practice in economical corrosion protection. To provide this protection, Tidewater engineers took full advantage of the properties of high nickel alloys. You'll find the details in the table below.

Throughout this ultra-modern refinery, high nickel alloys such as Monel* and Inconel* combat corrosion by mineral acids and other troublesome corrosives.

For more information, or for help with a corrosion engineering problem of your own, write Inco's Development and Research Division.

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall St. New York 5, N. Y.

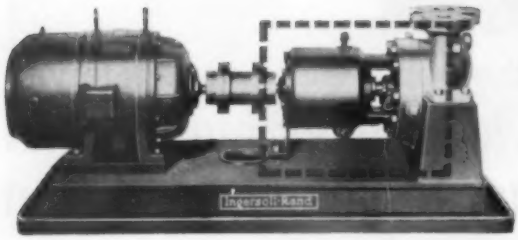
INCO
TRADE MARK

Schedule of Use of Monel nickel-copper alloy to combat corrosion by aqueous H_2S and HCl in fluid coker at the new Tidewater Refinery**

	EQUIPMENT	LOCATION	MATERIAL
Columns:	Fractionator	Top head	Monel-clad steel
		Shell, tray #17 to top	Monel-clad steel
		Trays #17, 18, 19	Monel alloy
Vessels:	Fractionator-accumulator	Nozzles	Monel alloy
	First commingler drum	"	" "
	Second commingler drum	"	" "
	Stabilizer accumulator	"	" "
	Blowdown quench drum	"	Monel alloy
	Main water seal vessel	"	" "
	Bypass water seal vessel	"	" "
Pumps:	Foul water pump	Casing, impeller	Monel alloy
Piping:	Foul water line, accumulator to stripper		Monel alloy

*Registered trademark **Where temperatures go above 800°-850°F, nickel-containing type 316 stainless and stainless-clad steel are also extensively used in this unit.

INCO NICKEL ALLOYS

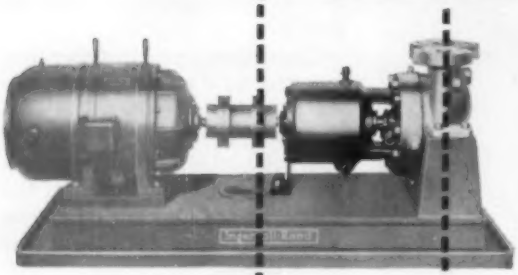


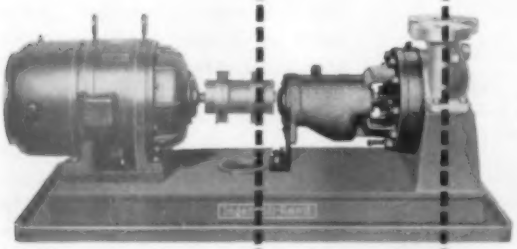
This "multi-process" pump

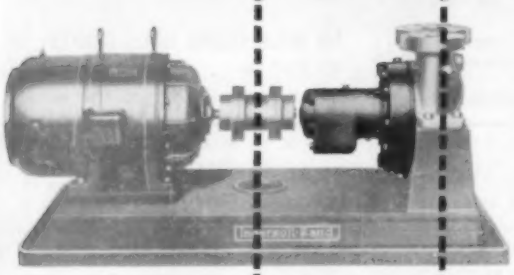
now handles

a wider range of applications

with unequalled interchangeability of parts







Here's how Ingersoll-Rand "tailors" its SFL line of heavy-duty pumps to meet your process requirements at least cost:

SFL . . . high-temperature service up to 800°F.
This is the basic water-cooled heavy-duty pump which has gained industry-wide acceptance for ruggedness and long-term dependability. It is designed specifically for hot-liquid services and is available with packed box or mechanical seals.

SFLM . . . medium temperature up to 300°F.
Take away the water-jacketing from the SFL and you have the SFLM . . . the same rugged pump *at a lower first cost*, designed for medium-temperature service. Should you later decide to put this pump on high-temperature service, *you can easily convert it to water-cooled operation.* Simply change to a water-cooled stuffing box extension and bearing housing. Available with packed box or mechanical seal.

SFLA . . . up to 200°F . . . with built-in mechanical shaft seal as standard equipment.
The seal eliminates packing maintenance and permits complete enclosure of the seal box . . . a definite safety factor. Within its rating, the SFLA is the most economical selection with single mechanical seal.

3 designs for one basic pump...
all available with top or end suction for heads to 750 ft, capacities to 900 gpm

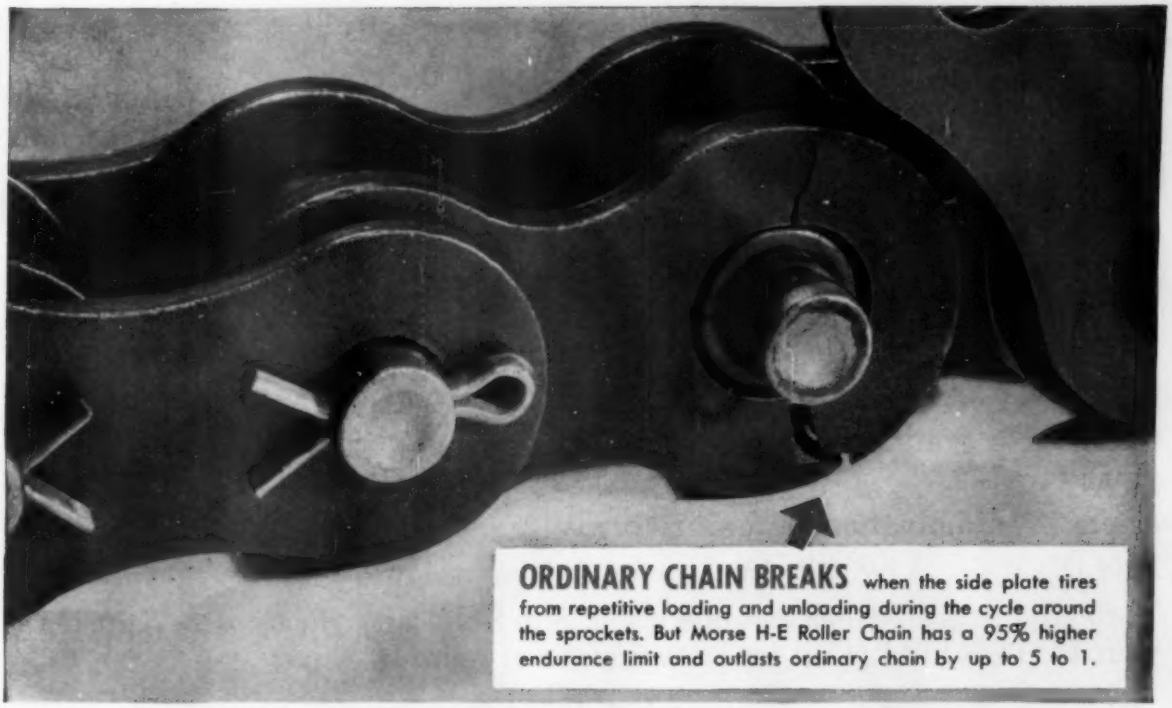
WITH Ingersoll-Rand's newly extended line of "multi-process" pumps, you can now select from three basic types . . . and get exactly the pump you want for each specific application. You get maximum interchangeability of parts, plus the first-cost economy which results from a basically *standard* production model.

Whether your process can be best served by one of these "multi-process" pumps or by other models manufactured by Ingersoll-Rand, you can be sure that your I-R pump specialist will give you objective, expert counsel. Ingersoll-Rand makes *the most complete line of centrifugal pumps* available for the process industries.

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

THERE'S NO SUBSTITUTE FOR EXPERIENCE IN ENGINEERED PRODUCTS



ORDINARY CHAIN BREAKS when the side plate tires from repetitive loading and unloading during the cycle around the sprockets. But Morse H-E Roller Chain has a 95% higher endurance limit and outlasts ordinary chain by up to 5 to 1.

"Tired Metal"... the bane of chain now licked by MORSE H-E

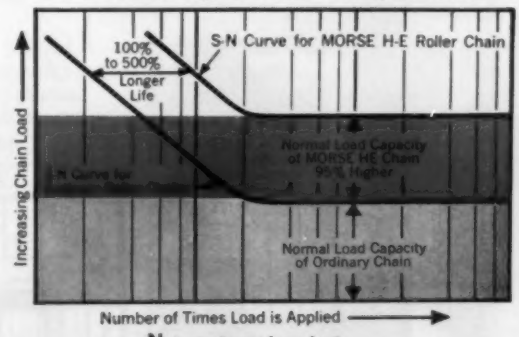
Morse H-E Roller Chain outlasts ordinary chain by up to 5 to 1 . . . can save you thousands of dollars annually on tough drilling jobs

Deep drilling puts chain under terrific loads and shocks until metal "tires," and ordinary chain breaks. But a special process gives Morse H-E Roller Chain 95% higher endurance limit . . . up to 500% longer service life.

This special process means Morse H-E Chain costs up to 10% more. Yet that's a small price to pay for heavy-duty oil-rig chain that can save you thousands of dollars yearly in replacement costs and downtime.

For more information on the chain that licked the "tired metal" problem, check your favorite supply store. Or write: MORSE CHAIN COMPANY, Dept. 22-98, Ithaca, New York. Warehouses in Casper, Wyoming; Houston and Odessa, Texas; Farmington and Hobbs, New Mexico. Export: Borg-Warner International, Chicago 3, Illinois.

Chain Life: Morse High Endurance vs. Ordinary Roller Chain


100% to 500% Longer Life
S-N Curve for MORSE H-E Roller Chain
Normal Load Capacity of MORSE HE Chain 95% Higher
Normal Load Capacity of Ordinary Chain
Increasing Chain Load
S (stress)
Number of Times Load is Applied
N (number of cycles)

Red area: Under these chain loads, fatigue will break ordinary chain . . . but not Morse H-E.

White area: Under these loads, fatigue will break ordinary chain and Morse H-E . . . but Morse H-E will have operated 100% to 500% longer.

IN POWER TRANSMISSION THE TOUGH JOBS COME TO

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Visit Morse at the Odessa Oil Show October 16-19

POTENTIAL

. . . here's *full* potential for oil refineries, chemical and heavy industrial plants, because . . .

FABRICATION . . . of all types of equipment *(Fractionating Columns, Gas Columns, Pressure Vessels, Plate and Heavy Steel Work, Special Machines, Autoclaves, Shells, Base Bridge Girders)* . . . is performed to order . . . to specification.

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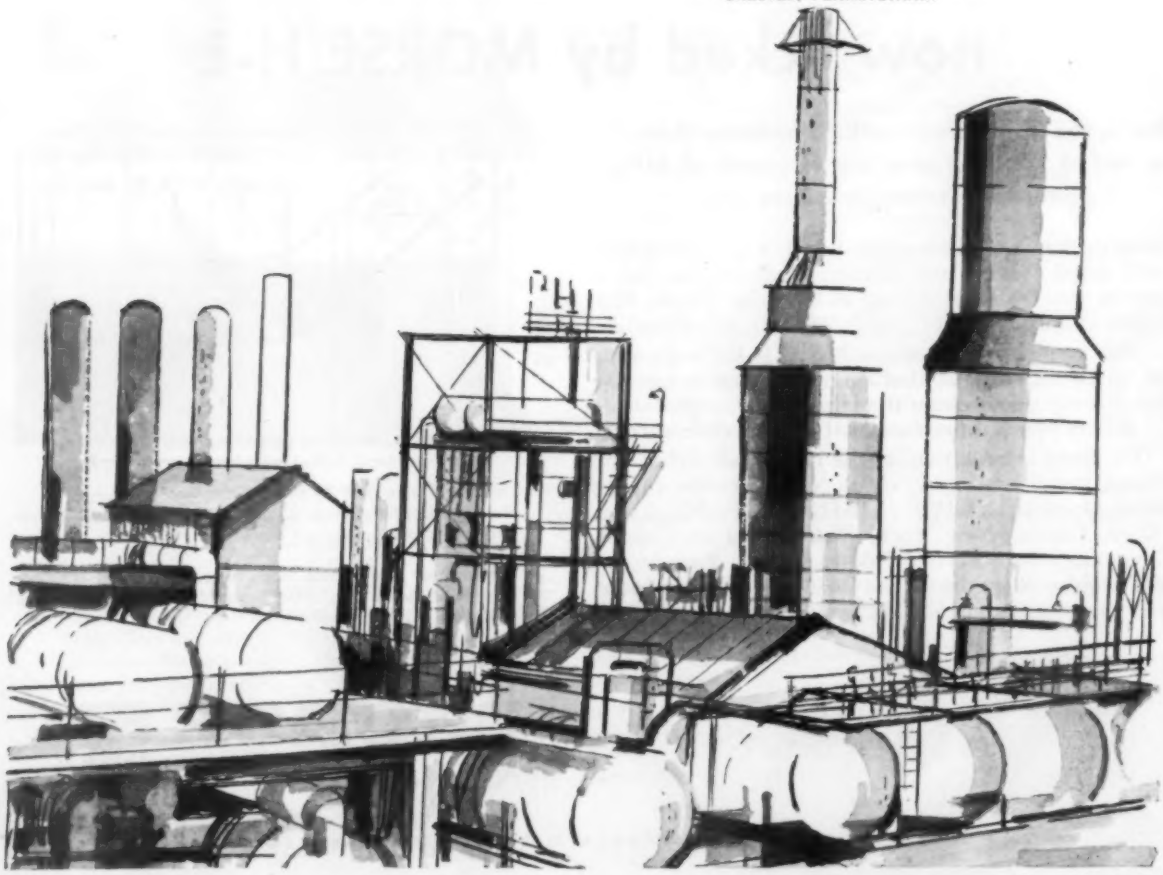

Two students, who hold scholarships awarded by American business, stop to talk to Dr. Howard R. Bowen, president of Grinnell College, Grinnell, Iowa. (L. to R.) Dr. Bowen; Janet Kispert of Stillwater, Minnesota; and Roger Soderberg of Elgin, Illinois. Says Dr. Bowen: "With its help to colleges and students, business is assuring a future source of leaders—not for itself alone, but for every phase of American life."

WHY SHOULD BUSINESS HELP COLLEGES AND STUDENTS?

College educations cost more today, too! In fact, for many young men and women —and for their parents—the increasing cost of a college education has become a major problem. And small, privately-financed colleges also have found themselves threatened by rising costs. Yet it is vitally important to America's future that our young people be well educated.

To help promising students and small colleges, we and other American companies have taken steps to give financial aid. Standard Oil, for example, has made funds available which provide for 34 graduate fellowships and undergraduate scholarships in science and engineering. Four-year scholarships awarded through the National Merit Scholarship Corporation also are included in this program. Thirteen students now are attending school on these scholarships. Supplementary grants are made to schools chosen by the Merit Scholarship winners.

In addition, Standard Oil has made funds available from which $175,000 is paid yearly to aid privately-financed liberal arts colleges in the Midwest and Rocky Mountain states.

At Standard Oil, where so much of our planning concerns the future, we believe there are few things more vital to the survival of our democratic, free-enterprise system than a well-educated public. That's why we provide for substantial financial aid to both colleges and students.

Dr. Laurence M. Gould, president, Carleton College, Northfield, Minnesota: "If it were not for financial help from business organizations, many capable students would be denied a college education. The far-sighted companies giving this aid are helping to conserve one of our most valuable natural resources."

Charles Riack of Chicago, National Merit Scholarship winner, and physics major at Notre Dame: "Business is helping to make it possible for many people to continue their education. Its concern for students and colleges shows a real long-range interest in national welfare."

What makes a company a good citizen?

One way of judging a company's citizenship is by its concern for the future—not for itself alone, but for the country as a whole. With business and colleges working together to build a stronger, more secure America through education, a brighter future is assured for us all.

STANDARD OIL COMPANY
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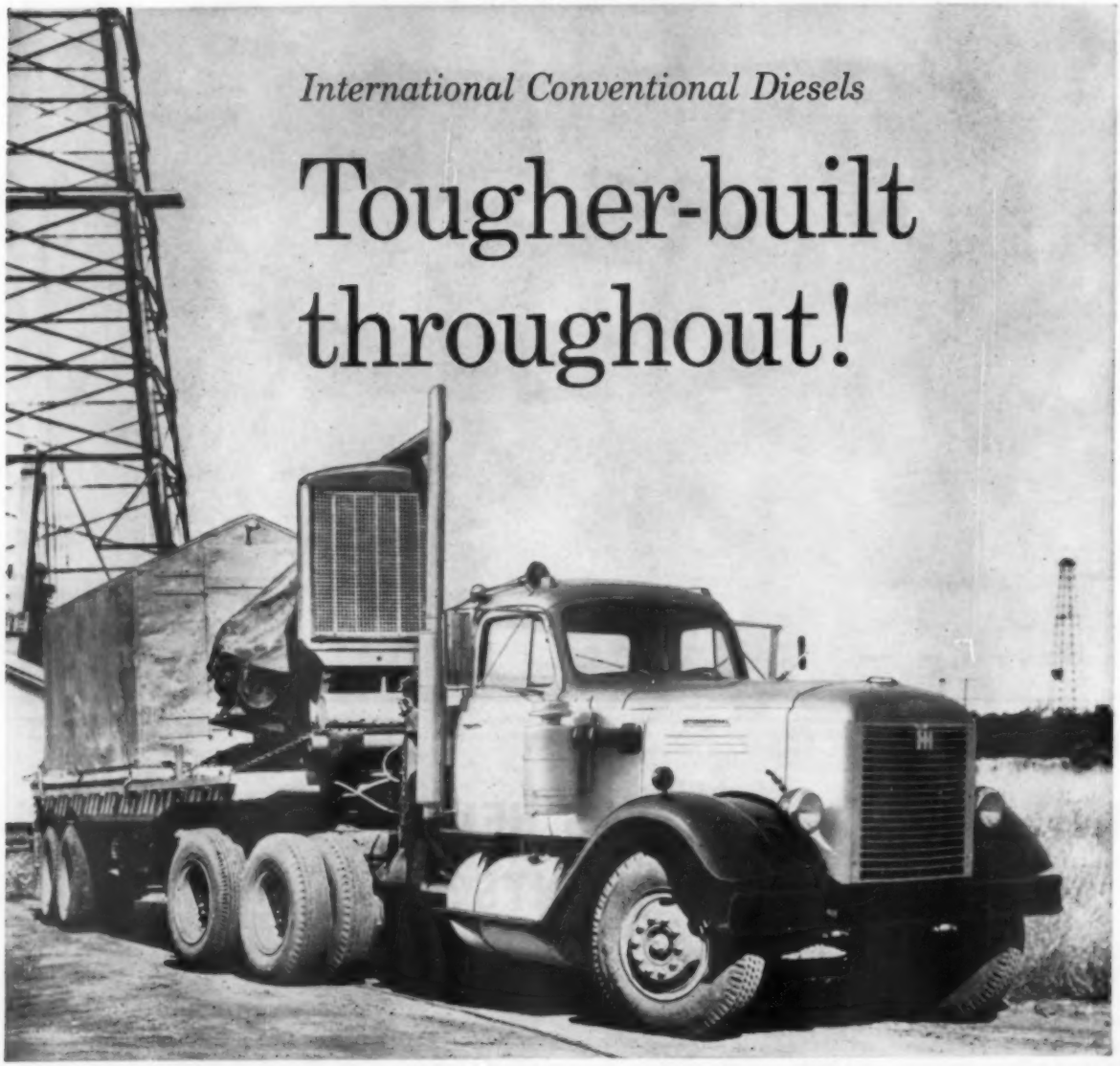
STANDARD

THE SIGN OF PROGRESS...
THROUGH RESEARCH

International Conventional Diesels

Tougher-built throughout!



INTERNATIONAL **conventional diesels** in the RD-400 series include four- and six-wheelers that range up to 76,800 lbs. GCW—with power options to 335 hp.

Here's a truck that is quality-built from component to component by truck specialists... gives you stay-at-it ruggedness that tackles any job.

Exclusive INTERNATIONAL 4-inch-wide front springs are rigidly anchored with threaded pins and bushings for maximum service. Standard wide-tread 11,000 lb. axle and high 28-1 ratio geometric steering provide stability and ease of handling under the toughest ground conditions. Extra-heavy-duty tandems combine full flotation with positive traction for dependability on any terrain.

To learn more about the truck that can stand up under a daily pounding year after year... the truck that costs *least* to own*... see your INTERNATIONAL Dealer. Find out why INTERNATIONAL Trucks have been first in six-wheel sales for 23 straight years!

**Signed statements in our files, from fleet operators throughout the U.S., back up this statement.*

International Harvester Company • Chicago
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick® Farm Equipment and Farmall® Tractors

INTERNATIONAL TRUCKS cost least to own!

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We have long been leaders in the design and construction of wharfage facilities, both at home and abroad.

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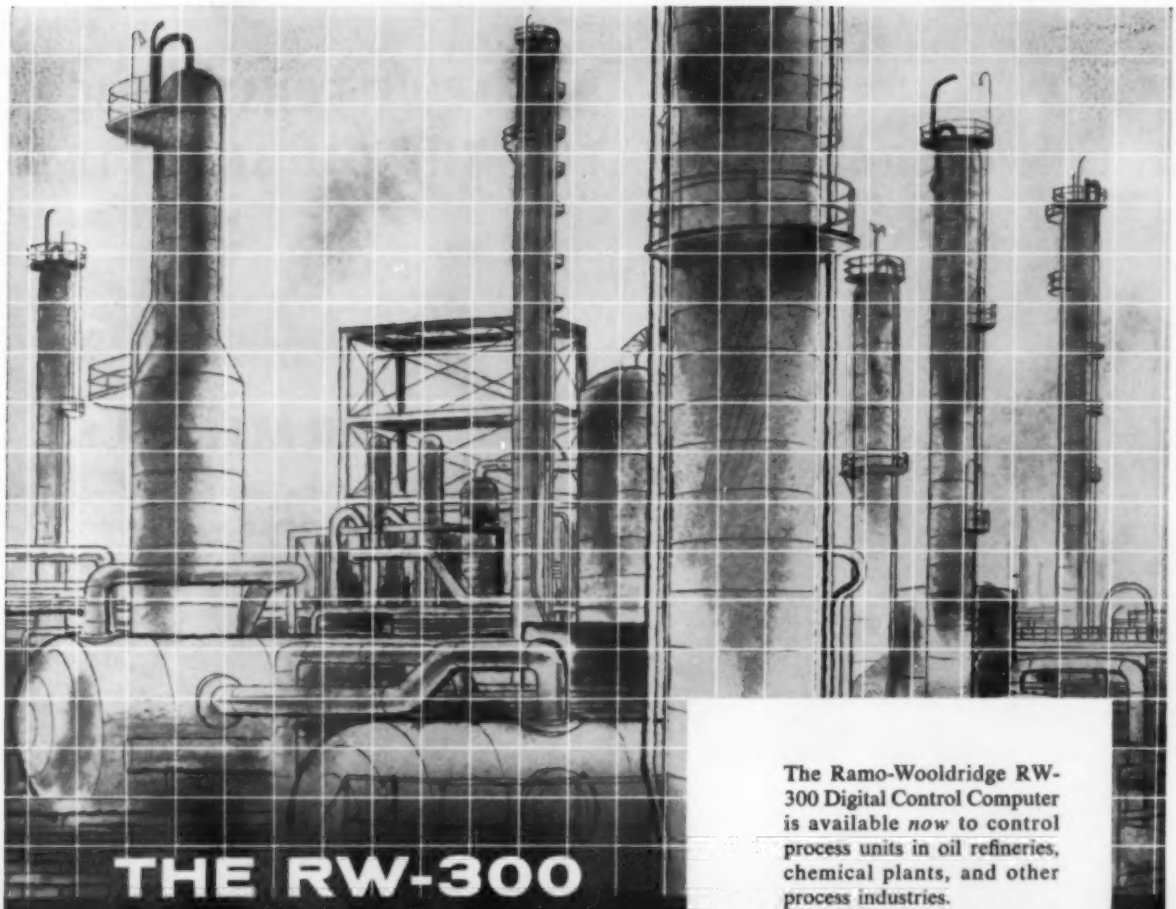


THE RW-300

is the first digital computer for automatic process control and data logging

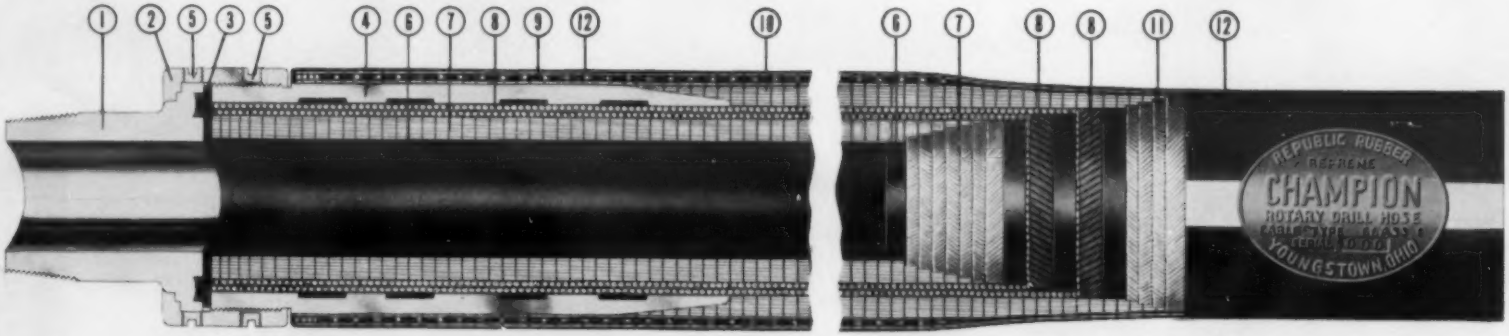
The Ramo-Wooldridge RW-300 Digital Control Computer is available *now* to control process units in oil refineries, chemical plants, and other process industries.

The new RW-300 offers outstanding opportunities for higher profits from existing and future plants—through reduced operating costs, increased throughput and yields, and improved product quality. These benefits will pay back an investment in an RW-300 digital control system within six months to two years.

For technical information on automatic process control and advanced data logging with the RW-300, write: Director of Marketing, The Thompson-Ramo-Wooldridge Products Company, P.O. Box 45067, Airport Station, Los Angeles 45, California, or call OSborne 5-4601.

THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS COMPANY

Here's the INSIDE STORY...



12 REASONS WHY REPUBLIC CABLE-TYPE ROTARY DRILLING HOSE IS SAFER AND LONGER LASTING

1. **Nipple Head** of tough alloy steel will give maximum service. Standard A.P.I. threads.
2. **Collar** firmly attached to couplings. Will stay put.
3. **Sealing Gasket** specially compounded. Seals pressure in.
4. **Republic Couplings** give you a hose with no weak spots. In ordinary rotary hose, reinforcing wires or cables are placed over the couplings. Spacing between wires must be widened since O.D. of hose and coupling combined is greater than hose itself. These gaps create a weak spot at a critical point. Republic's new coupling design keeps the wire cable snugly and evenly spaced against the hose all the way and underneath the couplings . . . giving uniform strength the entire length of the hose and still maintaining the important full-flow feature.

THERE IS NO WEAK POINT IN A REPUBLIC ROTARY HOSE.

5. **Set Screws** prevent loosening of collar and nipple head.
6. **Hot Oil & Abrasion-Resistant Reprene Tube** resists wear of corrosive drilling muds, withstands swelling and softening effect of oil.
7. **Multiple Fabric Plies** give greater resistance to pressure.
8. **Steel Cables** imbedded in rubber guarantee strength and reduce pulsation and vibration during pressure surges.
9. **Circumferentially-Wound Steel Cable** reinforces ends and prevents kinking at these critical spots.
10. **End Reinforcing Fabric Plies** work with the steel cables discussed in No. 9 to give even greater insurance against kinking and breaking at the vital hose ends.
11. **Additional Fabric Plies** give extra strength and permanently anchor reinforcing cables in place.
12. **Extra Tough Reprene Cover** will resist cutting, abrasion, and weathering. Oil resistant.

CLASS C

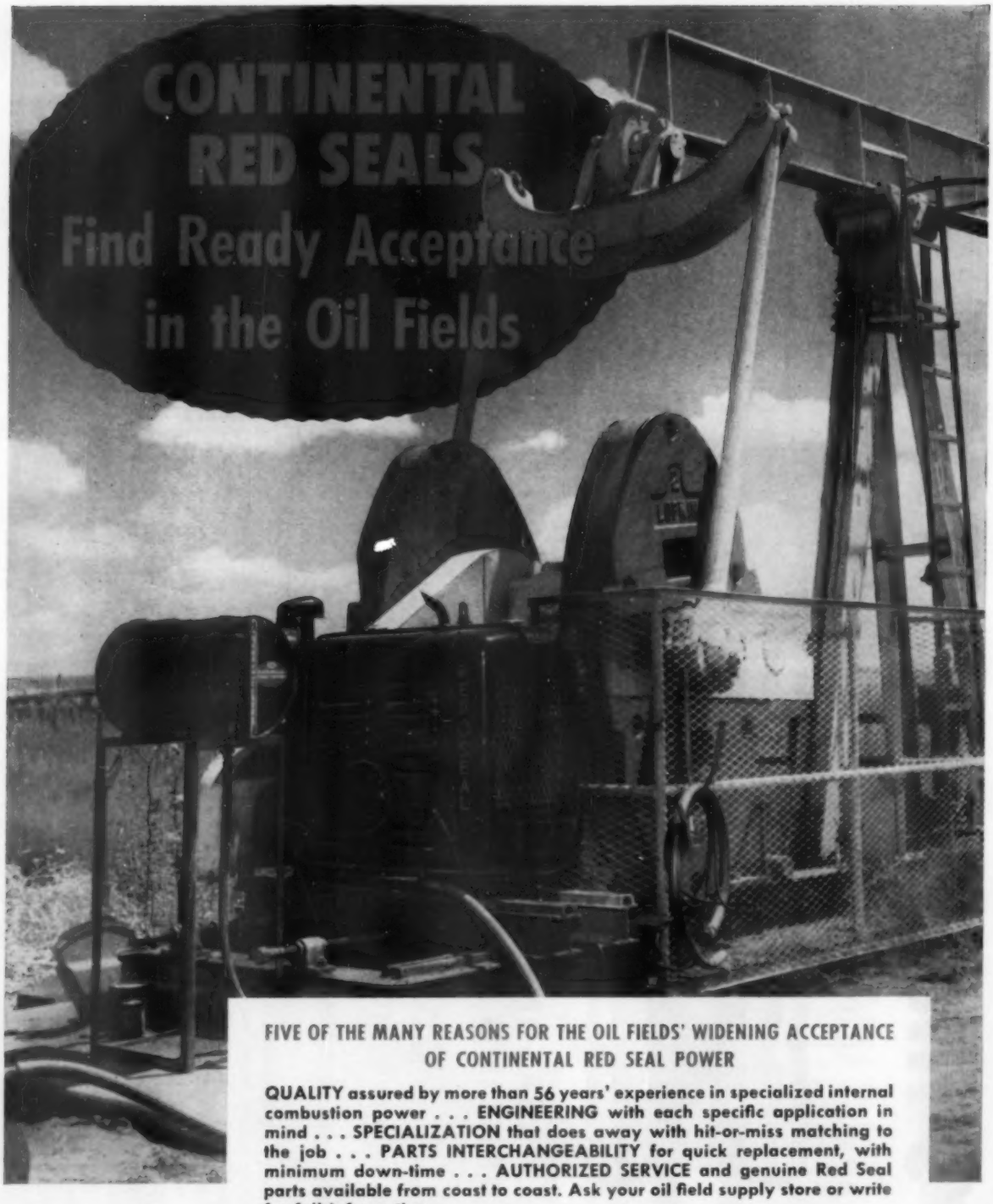
Each Length tested to 5,000 lbs.

THERE'S NO BETTER HOSE MADE!

REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS



FIVE OF THE MANY REASONS FOR THE OIL FIELDS' WIDENING ACCEPTANCE OF CONTINENTAL RED SEAL POWER

QUALITY assured by more than 56 years' experience in specialized internal combustion power . . . ENGINEERING with each specific application in mind . . . SPECIALIZATION that does away with hit-or-miss matching to the job . . . PARTS INTERCHANGEABILITY for quick replacement, with minimum down-time . . . AUTHORIZED SERVICE and genuine Red Seal parts available from coast to coast. Ask your oil field supply store or write for full information.

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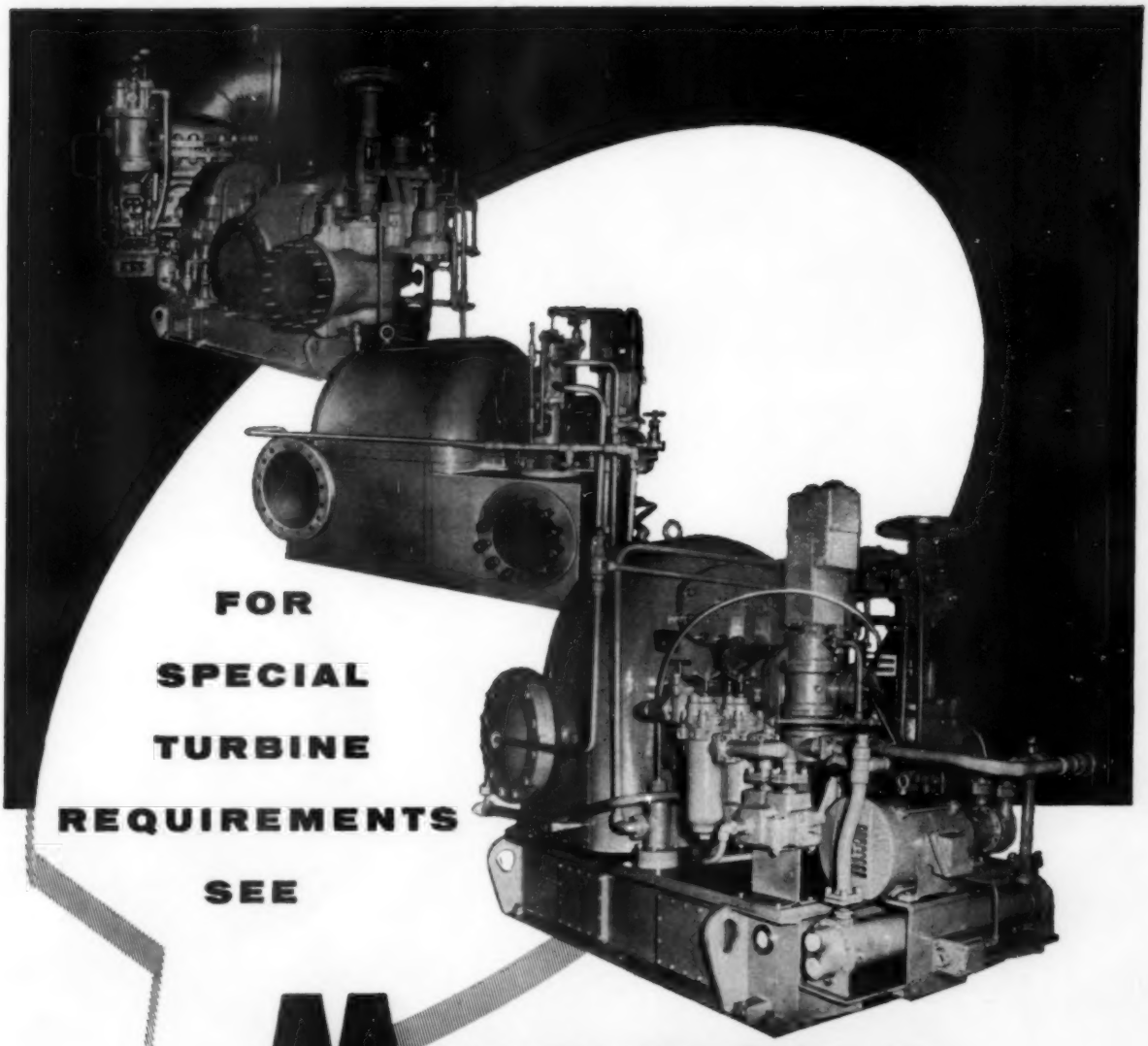
MUSKEGON • MICHIGAN



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Builders of Steam Power Equipment for Nearly a Century

Caustic soda and white reinforcing pigments, basic Columbia-Southern chemicals, are used throughout many industries. World's

COLUMBIA-SOUTHERN CHEMICALS HELP BRIGHTEN

IDEAS ON PARADE . . . reviewed every day by the management team building and selling successful products. Their responsibilities range from research and design to marketing and delivery.

These men and women make the profit-creating decisions for going, growing businesses . . . rubber goods, glass, textiles, petroleum products, metals, plastics, paper, food, chemicals, soap, foils and wraps, cosmetics, pharmaceuticals, disinfectants and cleansers. A vital part of their jobs is spotting and applying new trends in materials selection, processing, and handling that produce better goods at lower cost.

The versatile basic chemicals brighten the prospect for continual improvement of almost all products and processes. Columbia-Southern, a leading producer of these essential industrial chemicals, can be a big help to your business as both supplier and technical adviser. Call Columbia-Southern with your next order. You'll soon see why Columbia-Southern chemicals, research, service, and technical assistance help brighten the future for products. The Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania. Offices in principal cities. In Canada: Standard Chemical Limited.

$NaHCO_3$—Sodium Bicarbonate • $CaCl_2$—Calcium Chloride • Na_2SO_4—Sodium Sulfate
KOH—Caustic Potash • CCl_4—Carbon Tetrachloride • NH_3—Anhydrous Ammonia

first practicable all-colored tires, above, were developed by Columbia-Southern. You'll be seeing more—many more.

THE FUTURE FOR SO MANY PRODUCTS

LOOK AT Cl_2—CHLORINE

Highly reactive chlorine's transforming touch creates thousands of molecular regroupings necessary to economical processing of products ranging from solvents to plastics, wonder drugs to refrigerants.

LOOK AT NaOH—CAUSTIC SODA

Petroleum producers and cellophane manufacturers, textile and rubber makers, businesses by the dozens put caustic soda's voracious appetite to work "eating" away unwanted organic or inorganic compounds.

LOOK AT Na_2CO_3—SODA ASH

This versatile alkali serves as basic raw material or essential "refiner" in the manufacture of glass, chemicals, detergents, ferrous and non-ferrous metals, pigments, soap, textiles, paper and many other items.

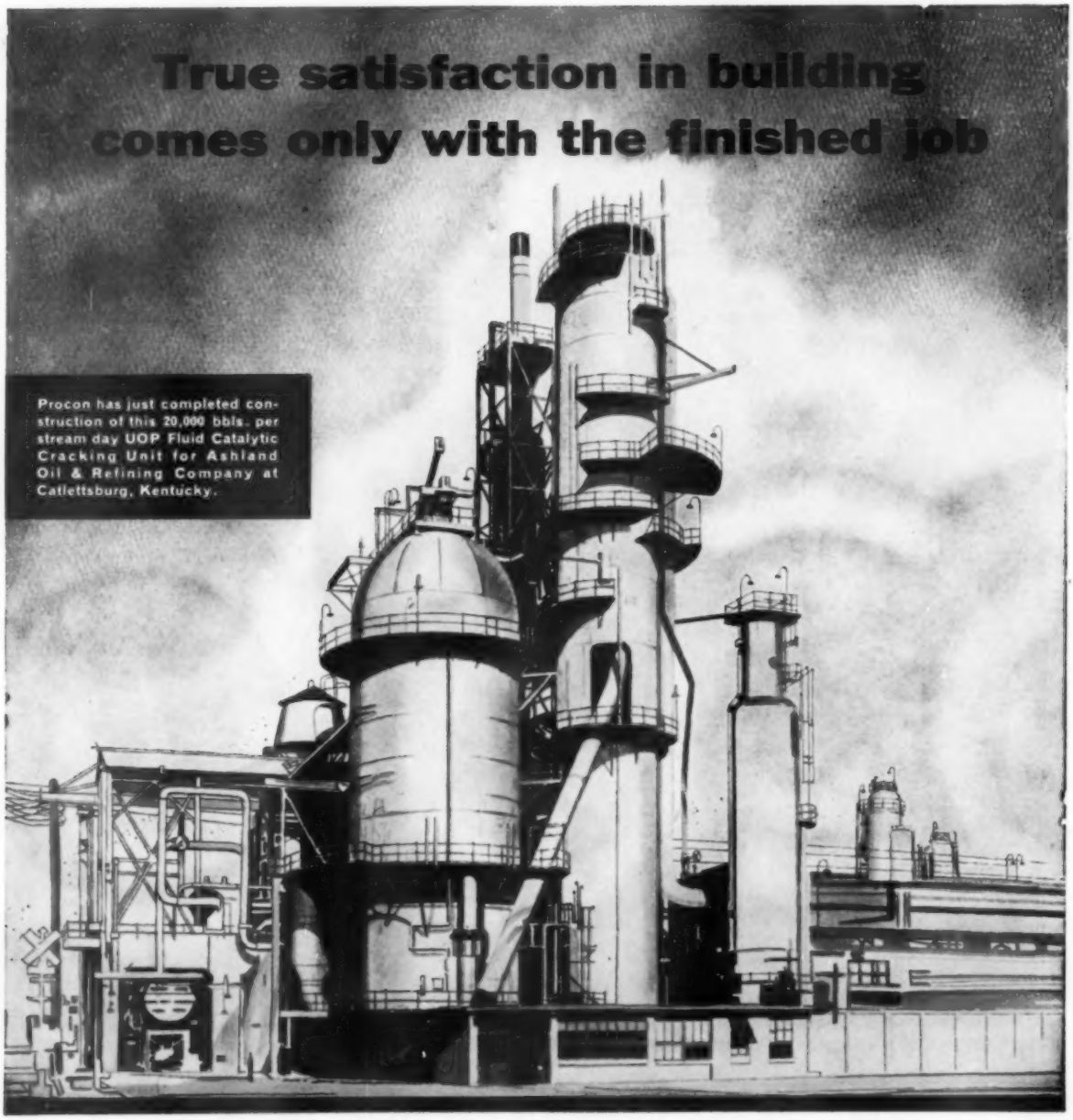
LOOK AT H_2O_2—HYDROGEN PEROXIDE

One of Columbia-Southern's newer products, this compliant chemical has a range of reactions that permits its use for bleaching paper and textiles, as a rocket propellant, as a reagent in organic syntheses.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION A Subsidiary of Pittsburgh Plate Glass Company

HCl—Muriatic Acid • $TiCl_4$—Titanium Tetrachloride • $Ca(OCl)_2$—Calcium Hypochlorite
Chlorinated Solvents • Chlorinated Benzenes • Agricultural Chemicals • Chrome Chemicals

True satisfaction in building comes only with the finished job



Procon has just completed construction of this 20,000 bbls. per stream day UOP Fluid Catalytic Cracking Unit for Ashland Oil & Refining Company at Catlettsburg, Kentucky.

Here at Procon we take a lot of satisfaction in all phases of our work as builders. Everything we do, from designing and engineering through each stage of construction, gives us that feeling of accomplishment which is so rewarding a part of any job well done.

We only get our fullest measure of satisfaction, though, when the job is finished, faithfully done to every requirement of specification and time.

Procon's experienced organization plans and builds refineries, petrochemical and chemical plants anywhere in the free world. You can count on any project you trust to Procon being completed to your true measure of satisfaction, too.

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U. S. A.

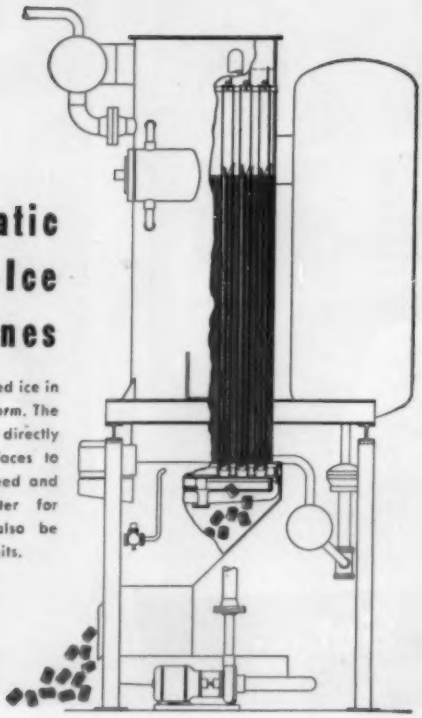
PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA
PROCON (GREAT BRITAIN) LIMITED, LONDON, W. C. 2, ENGLAND
PROCON INTERNATIONAL S. A., SANTIAGO DE CUBA

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL AND CHEMICAL INDUSTRIES

GET AHEAD with . . . "YEARS-AHEAD" . . .

Automatic Tube-Ice Machines

Make clear, hard, sized ice in cylinder or crushed form. The refrigerant is applied directly to the freezing surfaces to produce ice with speed and economy. Cold water for process work can also be supplied by these units.



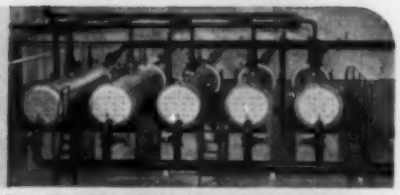
Vogt

ICE MAKING and REFRIGERATING EQUIPMENT

. . . for the preservation of foods and beverages during process and in storage. Petroleum refineries, chemical plants, and related industries also employ this equipment in various processes. In addition to equipment shown here, we manufacture liquid receivers, pipe coils, and valves, fittings, and flanges, for refrigeration as well as for high pressures and temperatures. Bulletins on request. Address Dept. 24A-8[illegible].

Refrigeration Condensers

Available in horizontal multipass shell and tube types and vertical single pass types for Ammonia or other refrigerants. Special metals, lined tubes, etc. can be furnished for unusual operating conditions.

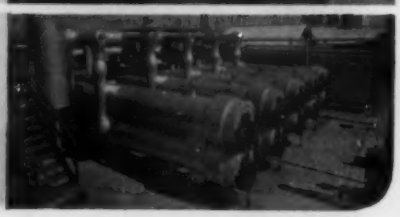


Brine Coolers

Multipass type brine coolers are ideal for closed brine systems in cold storage plants, dairies, packing plants, petroleum refineries, etc. requiring units of large capacity. Also suitable for cooling non-corrosive liquids in general.

Scraped Surface Exchangers

Continuously revolving scrapers sweep heat transfer surfaces clean and keep solids in suspension. Useful in problems of heat transfer with crystallization with high viscosity, or with solvent extraction. Available in double pipe and shell and pipe construction.

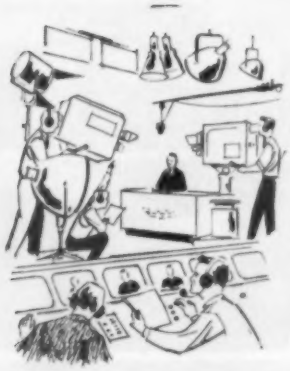


HENRY VOGT MACHINE CO., Louisville, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati

OTHER VOGT PRODUCTS — DROP FORGED STEEL VALVES, FITTINGS AND FLANGES IN A COMPLETE RANGE OF SIZES • PETROLEUM REFINERY AND CHEMICAL PLANT EQUIPMENT • STEAM GENERATORS

there's more to Cities Service than meets the eye!



Behind the performers on even the simplest television show is at least one writer, producer, director, camera crew, prop man and engineer—to say nothing of the fantastic network of electronic equipment that transmits their efforts to you.

The newscaster who brings a summary of the day's events appears alone on this screen, but behind him—unseen by the TV audience—are thousands of men and women who made his program possible. They include the people who designed and built the facilities of TV transmission, cameramen, technicians, script writers, directors, producers, newsmen throughout the world, and many others.

Producing gasolene is like that. To provide the motor fuel which flows from pump to car requires a host of people who must find and produce the crude oil, refine it, test it in laboratories, transport it to distributing points, and finally deliver it to the station tanks to await the customer's order to "fill 'er up."

In the case of Cities Service, one of the nation's leading oil companies, all this required a capital investment of more than $179,000,000 in 1957 alone. It is money well invested, for petroleum products are vital to modern living—second only in importance to food itself.

CITIES SERVICE

YEAR 'ROUND BONUS!

You Get More Than Just a Valve When You Buy BS&B's

Super 70

Specification of BS&B Super 70 Diaphragm Control Valves on your next job will assure you of getting all of the following:

1. High Quality Product . . . The BS&B Super 70 Diaphragm Control Valve has high efficiency and stability. In addition to thousands of hydraulic flow tests performed in the laboratory, analysis of operating data gathered from Super 70's on stream in customer plants substantiate their excellent performance.

2. Application Engineering . . . Today's complex processing problems require detailed analysis to determine proper instrumentation and control applications . . . accurate control valve sizing. This is a regular service to Super 70 customers.

3. Start-up Assistance . . . After helping customers select the right valve for a specific job, BS&B follows thru by assisting at plant start-up time.

4. Time-saving Scheduled Maintenance . . . With the patented clamp ring—float ring closure, valve maintenance can be done in a fraction of the time required by conventional type valves . . . an economic must in future valve specifications.

Clamp Ring — Float Ring Closure

Flanged — Gasket Closure

BS&B Super 70 Valves are available in either clamp ring—float ring, sealed bonnet or flanged-gasketed body closures. Whichever type you choose, when they're "on stream" you'll *know* that they're exactly right for the job.

Call your nearest BS&B office or representative now to discuss your present and future valve requirements. Or if you prefer, write for detailed information.

BS&B

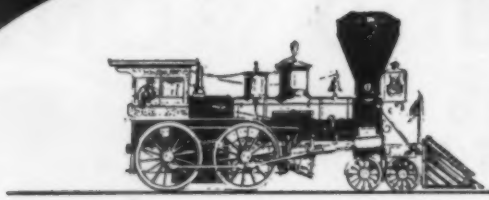
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Controls Division, Dept. 4-A9

7500 East 12th Street

Kansas City 26, Missouri

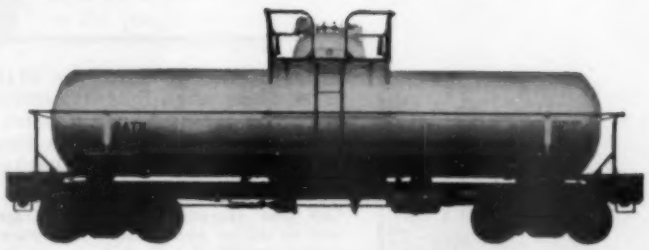


museum pieces are for museums

In 1869, this locomotive was the last word. Today, it is a museum piece.

Not so, your product. If it were, you'd be in the museum business or out of business entirely.

But, if you ship a liquid in bulk, what about the package—the car in which your product goes to market?



Packages are for selling—whether they are on a shelf or on a railway siding. Your product deserves the best package you can find for it.

If your product is a liquid shipped in bulk, GATX builds or can build just the package for it—a tank car that protects your shipment and promotes your good name.

GATX operates the cars for you, knows where they are, keeps them on the move and maintains a nationwide network of shops for their service and upkeep.

No capital investment . . . no operating worries . . . when you ship GATX!

GATX GENERAL AMERICA TRADE MARK

GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street
Chicago 90, Illinois
Offices in principal cities

Seeing is believing . . .

CARBONOX*

Another Baroid Original

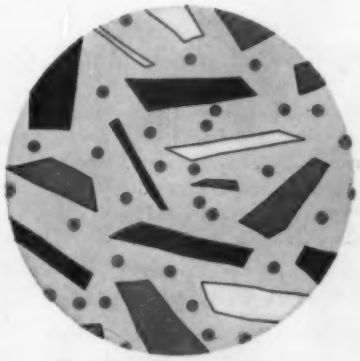
controls *drilling mud* **flow properties**

CARBONOX,
organic mud thinner,
used for more than 10
years in all areas at
all depths—

Economical
Simple to use
Reliable in results

If you are not using
CARBONOX *try it*
and find out why it
has won approval
for utility, efficiency
and economy.

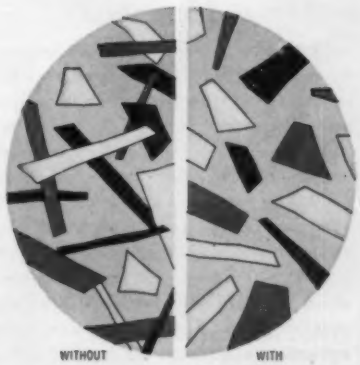
CARBONOX
—another example of
Baroid experience
and know-how!



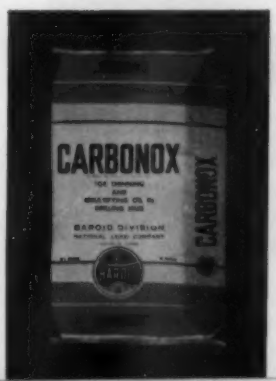
MAINTAINS GOOD EMULSIONS

THINS MUD WITHOUT DILUTION

KEEPS MUD STABLE AT HIGH TEMPERATURE



RESISTS EFFECTS OF SALT WATER



BAROID

BAROID

BAROID DIVISION • NATIONAL LEAD COMPANY

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

*Registered Trademark, Baroid Division National Lead Co.

B 5811

Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Glycol Dehydrators give 90°F. Dew Point Depressions...

Improved regeneration systems give high glycol concentrations

There are two methods commonly used today to dehydrate natural gas: one employs glycols; the other, dry desiccants. Most authorities agree that glycol systems are less expensive in both initial and operating costs. Recent engineering advances now permit dew point depressions up to 90°F. with economical glycol-type dehydrators. Union Carbide Chemicals Company maintains an extensive engineering service group designed to help the natural gas industry obtain the best possible dehydration service with CARBIDE's diethylene glycol and triethylene glycol.

A GRADUAL IMPROVEMENT

Diethylene glycol was first used to dehydrate natural gas in 1936 and by 1939 sixteen glycol type plants were in service providing average dew point depressions in the range of 40°F. Triethylene glycol was first used to dehydrate natural gas in 1949. The dew point depressions realized with glycol type plants have gradually increased until today the standard guarantee is a 65°F. depression or gas containing seven pounds of water per MMSCF, whichever first occurs. For sometime now, some equipment manufacturers have offered a 75°F. dew point depression guarantee.

FACTORS INFLUENCING DEW POINT DEPRESSION

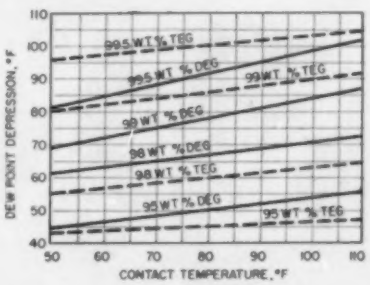
The dew-point depression obtained with a glycol dehydration plant depends upon several factors, such as:

1. Concentration of water in the lean glycol solution.
2. Glycol circulation rate.
3. Contact temperature in the top of the absorber column.
4. Efficiency of gas to glycol contact in the absorber.

Even with conservative design and operation, however, the dew point of the gas leaving the glycol contactor cannot be lower than the equilibrium value for the conditions of temperature and glycol concentration found on the top plate.

HIGH GLYCOL CONCENTRATIONS

The high diethylene and triethylene glycol concentrations now being obtained in plant practice, prompted studies to determine the dew point depressions obtainable with such solutions.



These data indicate that both diethylene and triethylene glycol at 99.5 per cent concentrations provide dew-point depressions in the 80°-105°F. range.

At concentrations of 98 per cent and lower, diethylene glycol provides better depressions than equal concentrations of triethylene glycol, while at 99 and 99.5 per cent concentrations, triethylene glycol appears to allow a 5°-10°F. lower dew point than diethylene glycol.

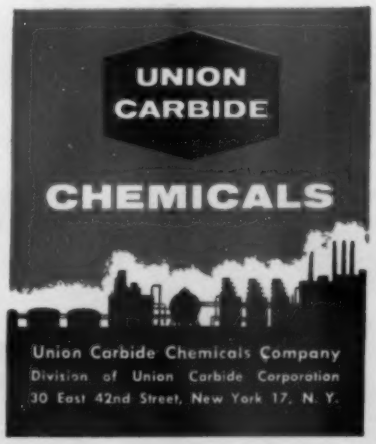
90°F. DEPRESSION MEETS TRANSMISSION REQUIREMENTS

Glycol regeneration equipment on the market today is capable of producing and maintaining glycol concentrations above 99%. Thus, it is possible for equipment manufacturers to guarantee a 90°F. minimum dew point depression. There are very few instances where a 90°F. depression will not meet the water content specifications of any long distance gas transmission company.

CARBIDE'S RESEARCH PROGRAM

Dew point depression studies are but one phase of CARBIDE's extensive research activities designed to improve the products and processes of the natural gas treating industry. CARBIDE's Technical Service Department stands ready to help you obtain the best possible results from your gas treating installations. For more information on the use of CARBIDE's glycols for gas dehydration, call the nearest CARBIDE technical representative or write, Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, N. Y.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation



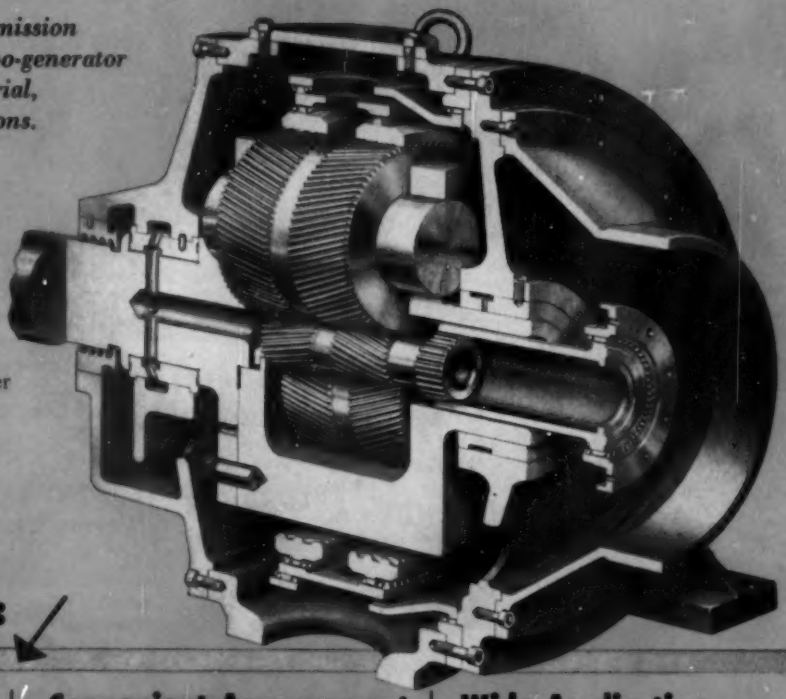
DE LAVAL-STOECKICHT
PLANETARY GEAR

...for high speeds...high horsepower

Proved in hundreds of installations abroad totalling over 3,000,000 horsepower—now available in America!

For all high torque power transmission applications such as pump turbo-generator and compressor drives in industrial, municipal and marine installations.

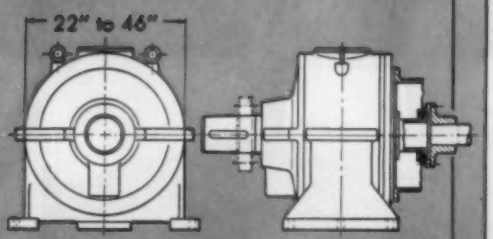
This cutaway view of the De Laval-Stoeckicht Planetary Gear shows how it provides flexibility for proper load distribution throughout the gear members. The thoroughly proved and tested design is completely reliable in transmitting high horsepower for high speed applications. • Highest efficiencies (98% or higher)...no high speed bearings...less friction losses.



Check These Advantages:

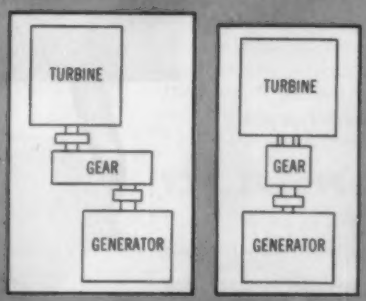
Small Size—Light Weight

Compact—low weight per hp. Sizes range from 22" to 46" in diameter, depending on horsepower requirements. Example: 5000 hp planetary unit weighs 1700 lbs. against 6000 lbs. for conventional gear.



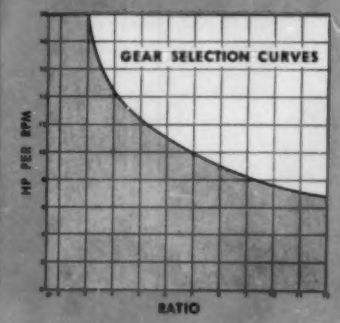
Convenient Arrangement

Co-axial or "in-line" arrangement of gear members takes up far less space than parallel axis gears of equivalent horsepower rating.



Wide Application

Capacity range shown in shaded area on chart below. For other applications, contact your De Laval Sales Engineer.



For further details, write for Bulletin 2400.

DE LAVAL *Steam Turbine Company*

810 Nottingham Way, Trenton 2, New Jersey

DL-481

FIRST QUADRUPLE STRING COMPLETION

Utilizes Brown Hydraulic Set Retrievable Packers

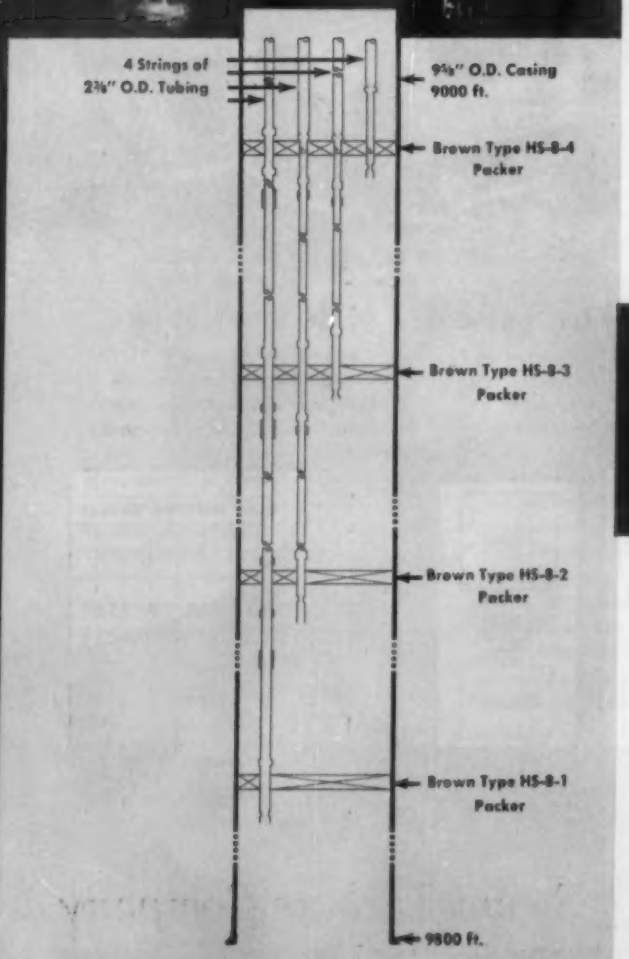
Oil Industry history was made in June of this year when the first quadruple string completion was made in an oil well by the CATC Offshore Group (Continental Oil Co., Atlantic Refining Co., Tidewater Oil Co., and Cities Service Production Co.). The well, the West Delta Block 30 Field, State 970, No. C-8, is located in offshore Plaquemines Parish and is the first well in history to produce four different zones through four individual tubing strings.

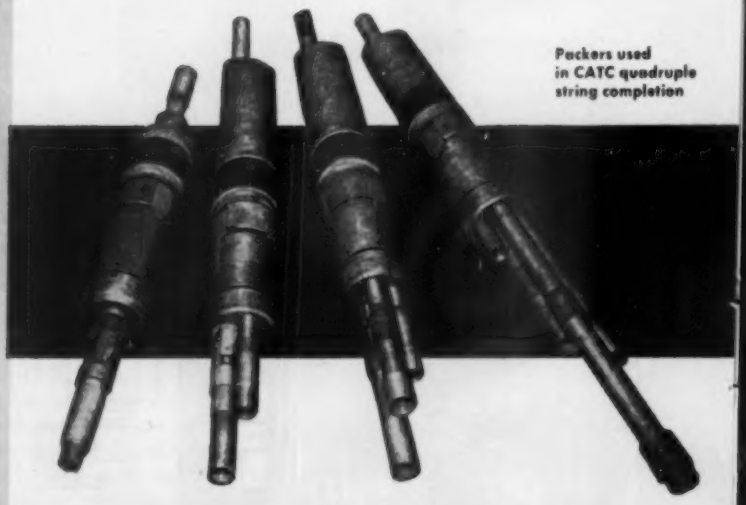
Four Brown Hydraulic Set Retrievable Packers were used in the well completion operation and installed by Brown Service Engineers. All four packers were run on the number one string and set in the interval of 9,000 to 9,800 ft. Each packer was set individually and tested from both directions prior to setting the next packer.

Years of research and testing went into the development and manufacture of the HS-8 Series packers. Single and dual Hydraulic Set Packers were successfully used over two years ago. A short time later, after continuous research, the triple string packer was perfected and accepted by the industry. Now, the development of the first quadruple string packer marks another engineering milestone in Brown's long history of firsts.

Brown equipment was used in the first detachable dual string completion, the first detachable triple string completion, and *now*, the first quadruple string completion.

Let "P·R·I·M·E Completions by Brown" save you money. For complete brochure on Hydraulic Set Packers write Brown Oil Tools, Inc., P. O. Box 19236, Houston 24, Texas.

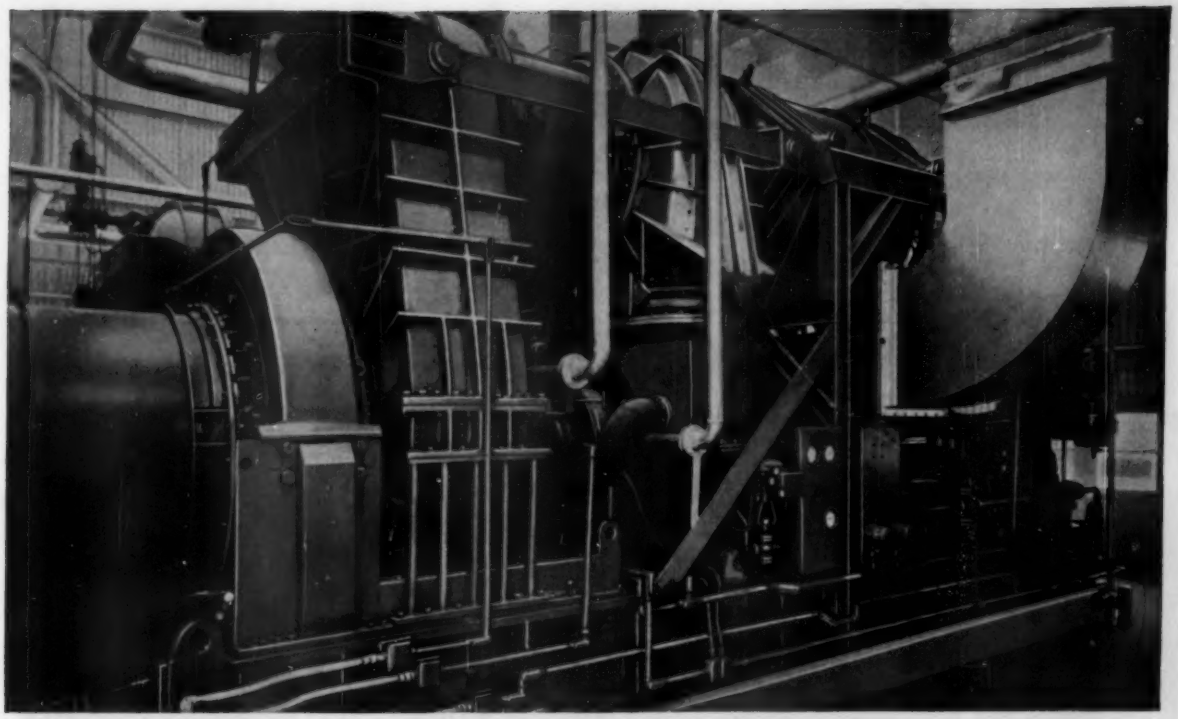




Packers used in CATC quadruple string completion

BROWN
OIL TOOLS, INC.

8490 Katy Road, Houston, Texas.



In BUTADIENE APPLICATION Clark Gas Turbines supply regeneration air

Odessa Butadiene Company's new plant at Odessa, Texas, integrates two Clark Model 305 gas turbines in the butadiene process by using them to furnish regeneration air to the dehydrogenation unit. These turbines operate in parallel, along with a Clark 3900 HP centrifugal compressor, and discharge air at 950°F and 22 PSIA into a direct fired heater, then to the reactor catalyst beds where the air removes carbon and replaces heat lost in the endothermic dehydrogenation reaction. This regeneration air is then directed to two waste heat boilers where it generates 186,000 pounds per hour of 250 psi steam.

Clark gas turbines were selected for this application because of better over-all plant economics which resulted from savings in fuel coupled with lower maintenance and operating costs. This plant is an operating testimonial of the dependability and versatility of the Model 305 gas turbine. The power turbine has been removed to allow the hot pressurized gases to be exhausted to the process, rather than convert the energy of the gases to mechanical power as is normally done.

Other services in which Clark gas turbines are in continuous operation are: catalytic reforming, ethylene production, and power generation. In the very near future, additional units will be used in repressuring projects in the Near East and Venezuela.

Clark gas turbines are available in sizes of 1150 to 9300 HP, and are precision engineered and built for the ultimate in dependable and economical heavy duty service. For complete information on Clark gas turbines, contact your nearby Clark representative, or write today for Bulletin 163-1 to Clark Bros. Co., 1115 Lincoln Avenue, Olean, New York.

Odessa Butadiene Company is owned jointly by El Paso Natural Gas Products Company, W. D. Noel and E. G. Rodman of Odessa, and the United Carbon Company.

CLARK BROS. CO.

One of the Dresser Industries

Sales and service outlets in principal cities throughout the world

CLARK

COMPRESSORS • GAS TURBINES

They Say—

An astonishing headline

Dear Sir:

Perhaps I am overly sensitive, but I was astonished (and that's putting it mildly) to note the cover of your August 4 issue and the heading "Oil is Getting Off Easy in Congress."

Getting off from what? To me, a headline of this kind implies that some penalty is due but is not being assessed. Actually, the article itself is not harmful, but I was surprised at the statement describing it on the cover.

In view of all of the discussion about improving oil's public relations, I wanted to share my opinion with you. I do know that oil-industry publications, such as The Oil and Gas Journal, have contributed much to the increased awareness in the industry of the need for better understanding by the public of our problems.

Robert L. Wood
Basin Drilling Co.
Midland, Tex.

Uranium story was well done

Dear Sir:

With reference to your publication of August 4, page 56, the article titled "Uranium 'Flooded'," we wish to commend you for your splendid presentation of our new process.

M. E. Richards
President
American Milling Corp.
Albuquerque.

No "bull" in Big Yellow Book

Dear Sir:

It has been several years since I have seen a copy of The Oil and Gas Journal, and I thoroughly enjoyed it.

Your down-to-earth attitude is refreshing and strikes a responsive chord in one who is weary of the "bull" and nonsense so often found in trade journals.

R. R. Burns
Gary, Ind.

Where competition's hot

Dear Sir:

Dr. Knappen, in his article about the FPC in the July 28 issue, says "the public would not tolerate . . . in one city . . . three competing gas distributing companies."

Apparently he is not acquainted with the city of Pittsburgh and some of its surrounding communities. At least three gas distributing companies are doing business there, namely, Equitable, Peoples, and Manufacturers.

I know of no case where all three compete on the same street—but I do know of cases where two of the companies have distributing mains on the same street!

A. H. McKee
Calgary

Regulation has a price tag

Dear Sir:

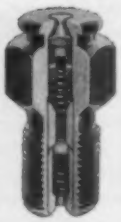
I would like to compliment The Oil and Gas Journal in publishing the article by Dr. R. S. Knappen, "Give FPC Credit for Trying" (OGJ, July 28, p. 156).

I believe the article is timely and that it describes the situation both from the standpoint of the FPC and

DELTA
HIGH PRESSURE GUN

This is no ordinary gun. It incorporates many important advantages and safety factors. Handles heaviest lubricants. Develops 10,000 lb. pressure. Positive mechanical spring primer. 30,000 lb. test barrel is cold rolled seamless steel tubing with heavy end sections and safe coarse threads. Hose tested to 20,000 lbs. Fast snap-on coupler enables operator to lubricate 10 to 15 valves *better, faster* and *safer* than he can one valve by conventional methods.

DELTA "GIANT"
API BUTTON
HEAD FITTINGS



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the gas producer better than any article that I have found so far.

I very much agree with his idea as set out in "What the author thinks should be done" in Item 2; that is, that Congress, the courts, and the commission should recognize that natural gas is a commodity and should be sold as other commodities are sold at the market price.

I think that any attempt by the Government to regulate any commodity such as oil, gas, coal, or grain is bound to cause too many complications and in the long run will prove burdensome and too expensive for the public.

In other words, it is not practical for the Government to regulate prices other than public-utility prices as set forth by Dr. Knappen.

H. A. Wright
President
Rogers & Wright, Inc.
Tulsa.

Drillers need instruments

Dear Sir:

I have read with great interest the article on faster drilling rates in the June 9 issue of The Oil and Gas Journal (p. 91).

As you probably know, the Drilling Contractors Association through the weight-speed-penetration subcommittee has been studying the subject through the conducting of field tests during the past 2 years.

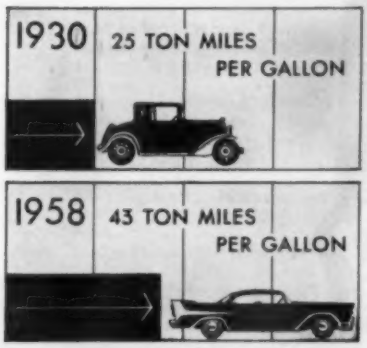
The main reason for writing this letter is to comment on a sentence in your article that states that no special tools are required in conducting tests of this nature.

Perhaps you are not aware, but Shell Oil Co. has been using our multichannel recorders on most of their drilling operations in Louisiana and also in various other areas throughout the country. The Drilling Contractors Association is also using this equipment on all of the weight-speed-penetration tests.

It is our opinion that in the conducting of any drilling tests it is most important that the operator have a good weight indicator, an accurate pump pressure gage, a rotary-table tachometer and, for best results, the multichannel recording equipment that we have used so successfully throughout the country.

Proper instrumentation is the key to a successful drilling study and without proper instrumentation the operator cannot be certain of the validity of the results of his test.

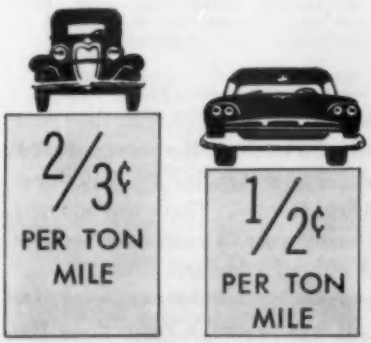
J. W. Knowlton
Sales Manager
Martin-Decker Corp.
Long Beach, Calif.



Today's gasoline has far more value. An accurate way to measure this value is by "ton-miles"...the number of miles a gallon of gasoline will move a ton of car. Average performance in 1930 was 25 ton-miles per gallon. Today it's 43 — or 70% more work per gallon.

Can you think of any liquid that costs less than gasoline . . . except water?

Quart for quart, gallon for gallon, almost any liquid you buy costs more than gasoline . . . and gasoline performance today costs less than it did in 1930.



Fuel cost per ton mile is down 18% since 1930. To move a ton of car a mile took ⅔¢ worth of fuel. Modern gasolines move today's heavier cars a ton-mile for about ½¢. When you remember you are buying performance, gasoline costs less today than in 1930.

In spite of higher operating costs in the oil industry, gasoline prices have been held down through research and intense competition. Since 1930 the price of gasoline (excluding taxes) rose only 23%. During the same period the general cost of living went up 70%.

The taxes on a tankful of gasoline would buy between four and five extra "tax-free" gallons. Combined state and federal taxes, which help pay for better roads, add about 9¢ to the price of every gallon . . . nearly 30% of your gasoline dollar buys no gasoline at all.

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CALENDAR

SEPTEMBER

6-7 Coating Society of the Houston Area, coating school, Hanna Construction Co., Houston.

7-12 American Chemical Society, fall meeting, Chicago.

10-12 National Petroleum Association, fifty-sixth annual meeting, Traymore Hotel, Atlantic City, N. J.

10-13 Intermountain Association of Petroleum Geologists, ninth annual field conference, Paradox basin.

14-17 University of Illinois, petroleum marketers management institute, Allerton Park, University of Illinois conference center.

14-19 Instrument Society of America, thirteenth annual instrument-automation conference and exhibit, Convention Hall, Philadelphia.

15-16 Independent Natural Gas Association of America, annual membership meeting, Roosevelt Hotel, New Orleans.

15-17 American Institute of Electrical Engineers, fifth electrical conference of the petroleum industry, Baker Hotel, Dallas.

18 Natural Gasoline Association of America, Rocky Mountain regional meeting, Gladstone Hotel, Casper, Wyo.

18-20 Rocky Mountain Association of Geologists, field trip, Maroon basin, registration, Glenwood Springs, Colo

21-24 American Society of Mechanical Engineers, petroleum division, mechanical engineering conference, Cosmopolitan Hotel, Denver.

22 University of Texas, third semiannual school of gas technology, 6-week term, Conroe, Tex.

22-24 American Institute of Chemical Engineers, national meeting, Hotel Utah, Salt Lake City.

24-25 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-25 National Association of Corrosion Engineers, San Joaquin Valley section, corrosion tour, Bakersfield, Calif.

25 Manufacturing Chemists' Association, Texas Chemical Council, chemical industry safety workshop, Shamrock Hilton Hotel, Houston.

25-26 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

25-27 Illinois State Geological Survey, biennial petroleum engineering conference, University of Illinois, Urbana.

29-Oct. 3 Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum, and aircraft engineering display, The Ambassador, Los Angeles.

OCTOBER

1-2 Western Petroleum Refiners Association, third annual stream-pollution and waste-disposal conference, Lassen Hotel, Wichita.

1-3 American Association of Oilwell Drilling Contractors, eighteenth annual meeting, Adolphus and Baker Hotels, Dallas.

3 American Institute of Chemical Engineers, South Texas section, thirteenth annual technical meeting, Moody Center, Galveston, Tex.

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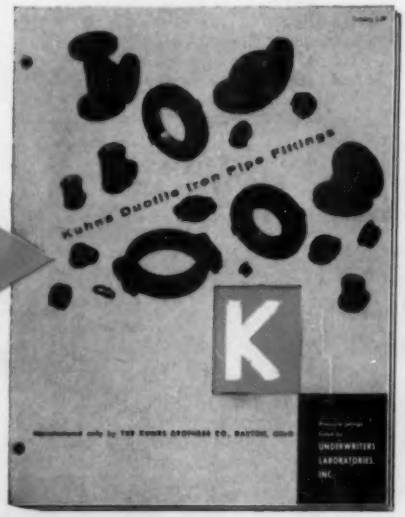

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5-8 Society of Petroleum Engineers of AIME, fall meeting, Houston.

5-8 National Association of Corrosion Engineers, northeast region, Somerset Hotel, Boston.

7-8 Texas Mid-Continent Oil and Gas Association, annual meeting, Statler-Hilton Hotel, Dallas.

9-10 California Natural Gasoline Association, thirty-third annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

10-12 Tri-State Oil Show, Roberts Municipal Stadium, Evansville, Ind.

12-18 OIL PROGRESS WEEK.

13-15 American Gas Association, annual convention, Atlantic City, N. J.

13-15 American Society of Mechanical Engineers, American Society of Lubricating Engineers, conference on lubrication, Statler Hotel, Los Angeles.

13-16 Society of Exploration Geophysicists, annual meeting. Hotel Gunter, San Antonio, Tex.

13-17 American Society of Civil Engineers, annual convention, Hotel Statler, New York.

15-16 South Dakota Independent Oil Men's Association, convention, Sheraton-Johnson Hotel, Rapid City.

15-16 University of Kansas, Southwest Kansas Center, sixth annual Gas Measurements Institute, Liberal, Kans.

15-17 National Association of Corrosion Engineers, north central region, Cincinnati.

16-17 Society of Petroleum Engineers of AIME, Southern California petroleum section, Biltmore Hotel, Los Angeles.

16-18 New Mexico Geological Society, Arizona Geological Society, ninth annual field conference, Black Mesa basin, registration Gallup, N. M., Oct. 15.

16-19 Permian Basin Oil Show, Odessa.

19-21 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Adolphus, Dallas.

20-21 Instrument Society of America, national rubber and plastics instrumentation symposium, Akron, Ohio.

20-24 National Association of Corrosion Engineers, south central region, Roosevelt Hotel, New Orleans.

20-24 National Safety Council, forty-sixth National Safety Congress, Conrad Hilton Hotel, Chicago.

22-23 National Association of Corrosion Engineers, western region, corrosion control course, U. S. Grant Hotel, San Diego, Calif.

22-25 Southwestern Federation of Geological Societies, regional meeting, Mineral Wells, Tex.

22-24 Society of Automotive Engineers, national diesel engine meeting, Lord Baltimore Hotel, Baltimore.

23-24 Rocky Mountain Oil and Gas Association, annual fall meeting, Town House Motel, Omaha.

23-24 Western Petroleum Refiners Association, refining technology and industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

27-28 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-28 Gulf Coast Association of Geological Societies, Driscoll Hotel, Corpus Christi, Tex.

26-31 American Institute of Electrical Engineers, general meeting, Pittsburgh.

NOVEMBER

5-6 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-7 American Association of Petroleum Geologists, Pacific section annual meeting, Los Angeles.

6-7 Louisiana Polytechnic Institute, School of Engineering, seventh annual instrumentation conference, Ruston, La.

6-8 Geological Society of America, national convention, St. Louis.

10 Transportation Club of the Petroleum Industry, annual meeting, Bismarck Hotel, Chicago.

10-13 American Petroleum Institute, thirty-eighth annual meeting, Conrad Hilton, Palmer House, and Congress hotels, Chicago.

18-20 Ninth National Conference on Standards, Hotel Roosevelt, New York.

18-20 National Conference on Air Pollution, Sheraton-Park Hotel, Washington, D. C.

20-21 American Society of Civil Engineers, structural division and Kansas City section, conference on electronic computation, Kansas City.

21 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

30-Dec. 5 American Society of Mechanical Engineers, annual meeting, Statler and Sheraton-McAlpin hotels, New York.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Kansas City.

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JOURNALLY SPEAKING

Beyond the 4-Cent Stamp

THE 3-CENT stamp is still around. But, like the nickel cigar, it isn't much in demand. It's mostly just a relic of a day gone by. The quality isn't quite the same.

To the housewife, the labor leader, and other miscellaneous letter-writers, the 4-cent stamp means another penny per letter—a 33% jump in a negligible item of expense.

But to a magazine man, it's a different-colored horse entirely. The newspaper columns and the hours of debate on the floor of Congress were all about the 4-cent stamp. Relegated to the background were some other postal changes of particular significance to readers of the Big Yellow Book.

These changes mean, simply, that Your Favorite Oil Magazine is now a bigger bargain than ever before, and probably will become even more so.

For example, if your sub is expiring, and you renew now for 3 years, we'll spend more on postage than you pay for the magazine. That's based on average figures. If you live in Midland, it may not hold. But if you're in Calgary, it's a gross understatement.

A look at the new postal rules turns up some interesting things. For example:

By 1961 $4.40 of the average Journal subscription price will be going to the Government in postage. If the rate is still $5, we'll be collecting 60 cents for the 52 issues.

But if you buy a 3-year sub in '61, we'll be paying $13.20 in postage to deliver your $10 order.

The changes aren't all the same. The farther U. S. readers are from Tulsa, the more we pay. This approach makes some sense.

But some increases seem all out of proportion. Canadian postage, for example, is due to go up 258% during the next 3 years. While we paid $3.02 to send the magazine to a Canadian reader last year, by 1961 we'll be paying $10.81—more than twice the price of today's subscription and more than three times as much in the case of a 3-year subscriber.

Foreign delivery generally will get soaked much harder than domestic. Only 15% of our subscribers live outside the U. S., yet their subs will carry over 40% of the postal-rate increase.

Whatever happens, we're not about to cut off our important and beloved readers abroad. They're some of our staunchest supporters. And many of them can prove it.

Of the 94 foreign countries and possessions where the Journal is sent, readers in seven of them order copies by airmail.

They pay from $77.16 a year in Guatemala to a top of $224.84 in Saudi Arabia. This is postage. The Journal is $5 more. Readers in Venezuela get airmail delivery for $117.60 extra, in Iran for $199.92 extra, in Libya for $156.20, and in Japan for $189.40.

We haven't had the heart yet to look into the new postal regulations and see what their new rates will be.

The domestic increases went into effect August 1. Luckily we have until January 1 to contemplate the bad news for our readers abroad.

Like the rest of the oil industry, our costs have been going up, too—on paper, ink, labor, and other outlays for publishing. But the postage increase is a little like getting hit between the ears with a bowling ball. It leaves you a little groggy.

While first-class postage jumped once — and only 33% — magazine postage has had several stiff increases. The year 1961, in fact, will see the sixth advance in 10 years.

Maybe if we get the circulation manager working a little harder, in another 10 years we can get the post-office out of the red. It's for sure that if postal rates keep going up we'll soon be losing so much on each subscription that it'll take one hell of a volume just to stay in business.

—Ted Armstrong.

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Guess who will now shape oil's public affairs

THERE'S a lot of sense on the API's new public-affairs program. Perhaps at last the industry is beginning to get progressive in its approach to this long-bungled problem.

It is difficult to understand why it took so long to coordinate the generalized public-relations effort with the specific government-relations work, or why so long to base the program on a broad local foundation instead of a New York City ivory tower.

Apparently it is now realized that public affairs are determined by the attitude of the public; that the public is composed exclusively of people; that people live all over; and that people's attitude toward oil is determined by oil men they happen to know or know about. So now it is oil men themselves who are to shape the public attitude on oil.

NOW EACH STATE or area will handle its own financing, staff, and organization. It can develop and administer its own program according to its desires and needs. This is not only democratic, but should turn up some new ideas and greater efficiencies.

This grass-roots approach should be welcomed by all who have griped about the old program. Now they can take part in their local groups and show how things should be done. It should also bring active participation by small companies and independents who have felt that their viewpoints were ignored.

With local associations taking the lead, we can expect first and greatest attention to be paid to local problems of public affairs, and some practical solutions to these problems. And if all local public-affairs problems are eliminated, can there be any national problem left?

BUT IT'S NOT QUITE THAT SIMPLE. National psychology and national policies are based on something more than the sum total of local attitudes toward local matters. Herein lies a danger that a completely decentralized and dismembered public-affairs program will fall short of achieving the objective of developing a climate in which a competitive oil industry can best serve the country.

Certainly the industry's machinery for dealing with public affairs is now much improved. But what may be lacking is some over-all mutuality of objectives and coordination of policies. Without such the various groups could become entirely preoccupied with state taxes and other purely local matters.

The answer is that local oil men who will now direct the program must learn to "think big," to "see the whole picture." In other words, they must exert the kind of leadership that will benefit the public affairs of the entire industry on a national basis.

If this can be achieved, the details and organizational structure of a public affairs program will become very unimportant.

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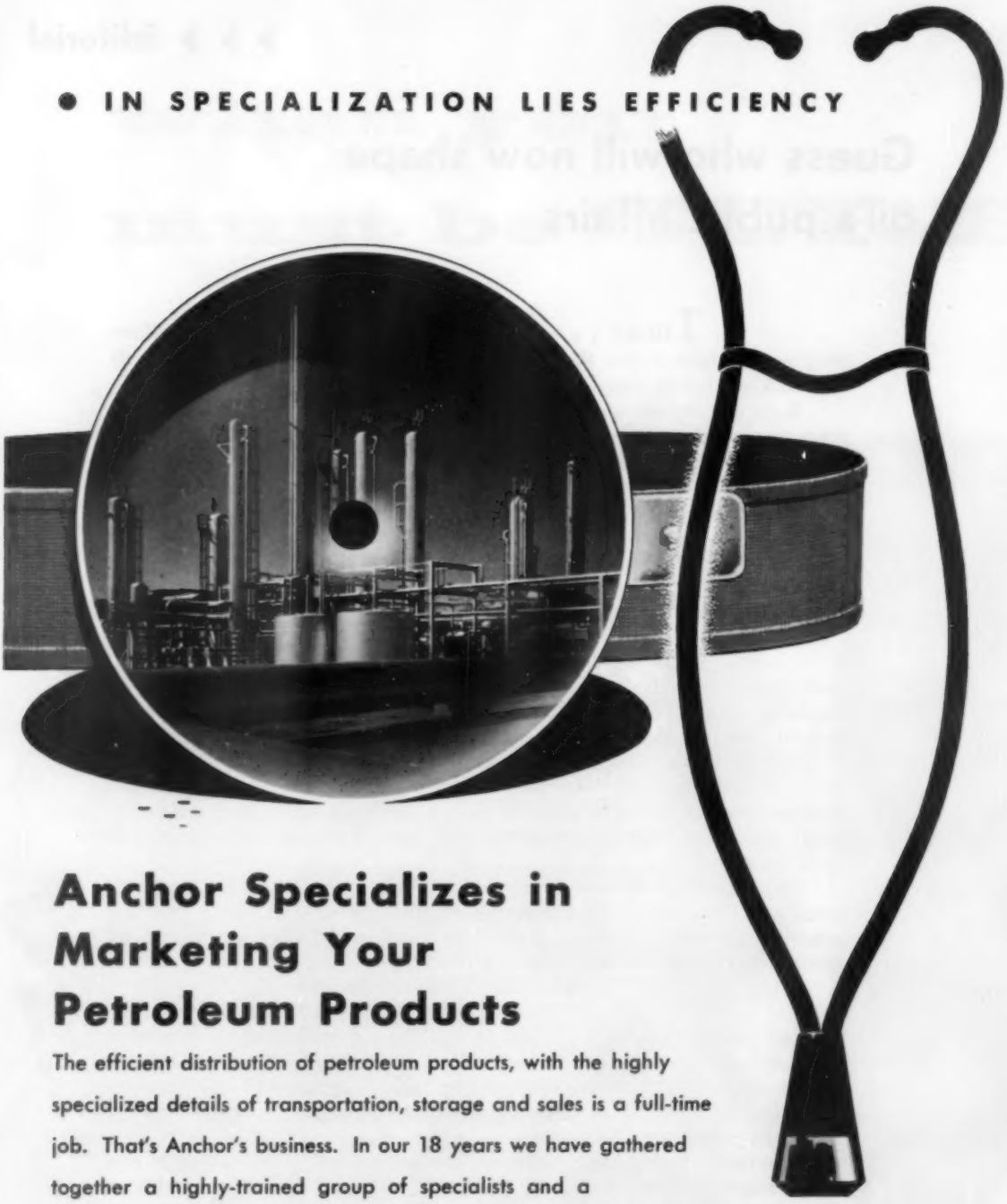

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Drastic Change in Import Plan Is Due

• Oil men will get to speak their minds on the program. Apparently it will give all refiners a chance to import crude based on throughput. Heavy quota requests have caused cabinet committee to adopt this new approach.

A NEW QUOTA system for the voluntary imports control program will be unveiled by the cabinet fuels committee this week.

And for the first time since the program was put into effect more than a year ago, the industry will be given an opportunity to say how it thinks the import problem should be handled.

Commerce Sec. Sinclair Weeks, committee chairman, promised this last week.

Weeks announced that a "proposal" for revision of the program for Districts 1-4 would be disclosed.

The industry will be given 30 days, he said, in which to submit written comments to Capt. M. V. Carson, Jr., imports administrator. At the end of that period, Carson is to submit a final proposal to the committee.

The new method of handling imports will go into effect next January 1. But it may be made public in advance of that date to give importers a chance to adjust their operations.

Weeks ordered the current schedule of quotas continued through the rest of this year. No new importers will be added to the list in that period.

Tied to throughput . . . Officials have not discussed the new plan formally. But it is generally believed that it will wipe out the present system of deciding who may import crude oil, and how much, in favor of a plan giving all refiners quotas based on their throughput.

The idea of handling the import problem in this way has been suggested repeatedly. It has met with considerable opposition. But recent developments may force a change:

. . . **New applications** for import quotas are greater than the present allocation of 713,000 bbl. daily. The applications total 808,000 bbl. daily. Only a fraction could be granted without wrecking the present setup.

. . . **A number of domestic** oil and coal associations have started moves for a further stiffening of controls, aiming at the inclusion of refined products.

. . . **The greatly strengthened** national-security clause of the 1958 foreign-trade act evidenced the intent of Congress that the import control program be applied diligently.

SINCLAIR WEEKS
. . . There'll be some changes made.

A total of 95 applications have been filed with Carson. Seventy are requests for initial quotas and the remainder for quota increases. These applicants were scheduled originally to be heard this month in a series of sessions before Carson. The hearings have been called off, but the applicants will have an opportunity to present their views through Weeks' invitation to submit comments.

Could trade oil . . . Any plan to give all refiners the same opportunity to benefit from foreign oil is expected to create a rift in the cabinet committee.

But oil men in Washington believe that such a system might go far to stabilize the industry. Since refiners who could not process foreign oil could make trades with others who need it, all would share equally in the economic advantage derived from imports.

Under such a plan, East Coast refiners who are geared to use foreign oil could obtain much of what they need through these trades.

While imports today could not be controlled by the formula followed nearly 20 years ago under the Venezuelan trade agreement, the basic idea underlying the reported new plan is similar—imports would be held to a fixed percentage of domestic refinery throughput. Under the Venezuelan agreement, entries were held to 5% to obtain the benefits of the reduced import tax.

Some would gain . . . A refinery-throughput formula would result in many changes in the relative position of present big importers, officials admitted. Atlantic Refining Co., Sinclair Oil Corp., Standard Oil Co. of California and Gulf Oil Corp. would have to accept lower quotas.

On the other hand, Standard Oil Co. (N. J.), Standard Oil Co. (Ind.), Pure Oil Co., and Continental Oil Co. would have higher quotas.

Questions remain . . . The suggested new system would have the advantage of simplicity, as against the 3-point base on which quotas now are set.

Working out a new system will be more complex than its application, however. While refiners can be given quotas on a purely percentage basis, some modifications will be needed to take care of a few importers who have an "historic" position in that field but do not themselves refine oil.

The plan . . . The transition from the present selective system to all-refiner quotas will be gradual, probably

spread out over all or most of 1959, it was said in informed quarters.

At the start, next January 1, a quota of 5 or 6% of throughput would be given all new importers, as well as those on the present list now required to import less. The bigger importers would be cut back, probably over a period of months.

The new system for providing for newcomers would be, in effect, that followed under the March 24 order setting the 713,000-bbl. level of crude imports.

A further revision would be made at midyear. The minimum quota would be increased, possibly to 9%, with the larger importers again subjected to a series of reductions.

A new study toward the end of next year would determine the course to be followed in 1960.

Refiners would not be allowed to sell their import certificates under this new plan, it was said. They would have to buy and arrange for the importation of their oil. But thereafter they could sell it to refiners needing foreign crude, or arrange exchanges.

Other products . . . There are no signs so far that the import controls will be extended to finished products. But they may be revamped to cover residual fuel oil imported for further processing.

Officials concerned with the problem do not believe that any controls should be placed on foreign residual which is to be burned as fuel. But the new plan may contain a provision that residual to be processed for other products should be considered as crude oil and charged against the importer's quota.

It is expected also that the program will continue to be voluntary. But the industry probably will be put on notice that the administration believes the new security provisions of the foreign-trade bill give sufficient authority for mandatory controls if needed.

Officials connected with the import program contend that it has been effective in reducing the impact of foreign oil and domestic producers. But they concede that the situation now shows signs of getting out of hand. They foresee that, unless the system is changed, more and more refiners will put in bids for quotas until, eventually, every refiner in the country has come in.

If the new plan is put into effect at the turn of the year, it is believed the overall level of imports will be lifted above the present 713,000-bbl. mark, as a result of increasing domestic demand. But officials say it is much to early to try to figure out how much of an increase may be possible.

LINED UP on track is the pipe—welded, coated, and buoyed. Then . . .

Delaware River Crossing Takes

LAUREL PIPE Line Co. last week installed a 6,800-ft. crossing of the Delaware River, bringing the 24-in. Philadelphia-Cleveland products nearer completion.

Missouri Valley Dredging Co., Omaha, pulled the crossing. It extends from a point east of River Road, N. J., to near Philadelphia International Airport half a mile upstream from Gulf Oil Corp.'s Hog Island wharf in Pennsylvania. The contractor buried the pipe 25 ft. below the bottom of the river, where the channel is 40 ft. deep.

Pipe for the crossing was 24-in. o.d.

Memphis-Case Challenge

REVERSAL of the District of Columbia Appeals Court decision in the Memphis case was asked of the U. S. Supreme Court last week by the Government and major pipelines.

The opposition of the Federal Power Commission, given in a brief filed for it by Solicitor General J. Lee Rankin, and the pipeline industry was laid before the court. Hearing of the case is expected this fall.

The Memphis decision held, in effect, that a pipeline company cannot file unilaterally for rate increases under Sec. 4(d) of the Natural Gas Act unless all customers under contract agree to the increase (OGJ, Dec. 2, 1957, p. 70).

The effect of the decision, if affirmed, would be to require most new rate-increase cases to be handled under Sec. 5. This section requires an investigation and decision on the merits by the FPC. Thus, it would take much more time to have an application decided. And, meanwhile, it would not be possible for a pipeline to put higher rates into effect under bond 5 months after suspension, as permitted under Sec. 4.

Members of the FPC last year made no secret of their concern over the effect of the decision. It was quickly appealed to the high tribunal by the Government and the affected pipelines.

An effort was made to get a quick decision from the Supreme Court. It was asked last winter to hear argument in April because otherwise the case would go over until the fall term which opens October 6.

The Government argued that the delay would prolong the "uncertainty and confusion" created by the lower court decision and some pipeline companies would defer expansion programs indefinitely.

The court, however, refused to advance the case.

Last week, Rankin told the court that "grave inequities" that will ulti-

FIRST SECTION enters the water, and . . .

THE 6,800-ft. Delaware River crossing is under way.

24-In. Products Line Closer to Its Destination

by ⅜-in. wall thickness seamless manufactured by National Tube Division, U. S. Steel Corp. H. C. Price Co. had contract to apply an asphalt mastic-corrosion coating and concrete-weight coating to hold the line in place. Weight of the pipe and coating was 625 lb. per foot. Each weld was X-rayed and the line was hydrostatically tested to 1,000 psi.

Laurel Pipe Line is owned by Gulf Oil Corp. (40%), The Texas Co. (25%), and Sinclair Pipe Line Co. (35%). Initial capacity will be 100,000 bbl. per day, but this volume can be more than doubled with increased horsepower when demand requires it. Laurel will be the first line to use 24-in. for products service. It will eclipse the Little Big Inch, whose 20-in. presently is the largest products line. Laurel is 24-in. at the Philadelphia end and tapers to 14-in. at the Cleveland terminus.

Is Lodged Before U. S. Supreme Court

mately hurt the consumer will result if the decision is allowed to stand.

There are three alternate ways by which pipelines could obtain higher rates. But none of them is satisfactory, Rankin said. They are:

. . . **Negotiation of separate** contracts with each customer. But there are "virtually insurmountable obstacles" to this. Refusal of some customers to accept higher rates might result in schedules violating bans against discriminatory rates.

. . . **Negotiations** between pipelines and customers. This would be a "difficult if not impossible" way of handling the problem, particularly in reaching an agreement which the FPC could accept.

The brief also pointed out the difficulty pipelines have borrowing money when their ability to obtain increased revenue depends upon "the weak reed" of cooperation by purchasers and local regulatory commissions.

. . . **The Sec. 5 proceedings** required by the lower court decision. It would be "wholly unrealistic" to expect action with sufficient speed to prevent a very substantial lag between the incurring of increased costs and the receipt of additional revenues.

The average time needed to finish a Sec. 5 case is 36 months, the court was told. To speed them up would require the cooperation of all purchasers—and the FPC doubts that this would be forthcoming.

Another point . . . Sec. 5 cases also pose a threat to consumers, it was pointed out.

If the pipelines have to use this method, the FPC foresees "almost irresistible pressure to fix rates on estimates rather than actual costs."

These estimates would likely err on the side of "sufficiency." The result would be a "substantial risk of inflated rates, contrary to the real interests of the consumers."

The effect of the Memphis decision is "to bar the pipelines from utilizing the means best calculated to give them the necessary rate flexibility while protecting the public interest, and to remit them to inefficient alternatives which will impair their ability to provide needed increases in gas service," the brief said in summing up.

"Neither the Natural Gas Act nor the Mobile decision requires that result, which is at war with the commission's long-established practice."

The Memphis decision, it was argued, will lead "to grave inequities, will ultimately hurt the consumer instead of protecting him, and is wholly unnecessary to a proper and valid administration of the Natural Gas Act in the spirit Congress intended."

Additionally, it was asserted, the use of Sec. 5 would create a serious obstacle to pipeline purchase of additional gas supplies, in view of rising field prices. And it would be a deterrent to new construction demanded by growing consumer needs.

Lease Sales Stopped

. . . on Louisiana-owned acreage. Lease bids this year have fallen far below estimates made by state budget group.

LEASING of state-owned lands in Louisiana has been suspended indefinitely because of lagging interest among bidders.

William G. Helis, Jr., chairman of the state mineral board, said scheduled lease sales, including one set September 18, have been canceled. Fifty-one tracts totaling approximately 30,000 acres were to be offered for leasing at this month's sale.

Helis said oil operators had been bidding so low for state acreage that "further lease sales would only sacrifice potentially valuable oil lands for a fraction of their real worth."

Because of lagging revenues, the mineral board previously had canceled its regular monthly lease sales in favor of bimonthly sales.

In announcing the latest move, the board chairman said "conditions will certainly have to improve a great deal before the board will consider another lease sale."

"We thought lease sales every 2 months instead of monthly might help," he added, "but that didn't succeed. Now we'll just wait."

Dwindling revenue from recent lease sales has fallen far below the estimates of state budget makers. An estimated $25,000,000 from mineral-lease bonuses this fiscal year was anticipated in drawing up the current state budget.

One bidding held . . . So far this fiscal year, only one lease sale has been held. Bids were invited on nearly 30,000 acres in that sale, which was held July 18, and bonuses were expected to total several million dollars.

But the sale proved to be "one of the worst leasings in the board's history."

The board reported that accepted bids totaled about $445,000 for 7,700 acres, an average of $57.36 per acre. Of the 45 tracts advertised, only five drew more than one bid.

In recent boom years, bonus bids of more than $1,000 per acre have been quite common.

Statistics released by Helis showed that the board received bonuses amounting to $28,208,014.07 in the calendar year 1957. That amounted to an average price per acre of $231.18 for the 122,015 acres leased. More than 48% of the acreage offered for lease drew acceptable bids.

During the first 7 months of this year the board accepted bonus offers of $9,798,606.10, averaging $156.64 per acre. More than 190,000 acres was offered for leasing, but less than one-third of the acreage actually was leased.

"Bidding on state lands has deteriorated to the point that the board has no choice but to reject many offers," Helis explained.

What now? . . . What's the board going to do about its plight other than "just wait"? Helis predicted the board would find other ways to raise money.

He pointed out that a fact-finding committee which has been checking on the status of state leases has discovered "numerous cases of nondevelopment, drainage, and nonpayment of royalties."

The committee was named more than a year ago after a major importing company suspended crude-oil purchases in two Louisiana fields and asked authority to shut in the production (OGJ, July 1, 1957, p. 99). The group's study was to determine, among other things, the feasibility of canceling state leases which had not been developed.

By the end of this year, Helis said, the board will have a complete study of all state leases.

"We will demand development or release of the acreage," he said.

5 Rumberger Hits 22,609 Ft.

SHELL OIL CO.'S 5 Rumberger, in the Elk City field of western Oklahoma, passed another milestone last week in its drive toward a 24,000-ft. objective.

The bit churned to 22,609 ft., which is well below the old world depth record of 22,570 ft., broken in recent months by two Phillips Petroleum Co. wells in Pecos County, Texas.

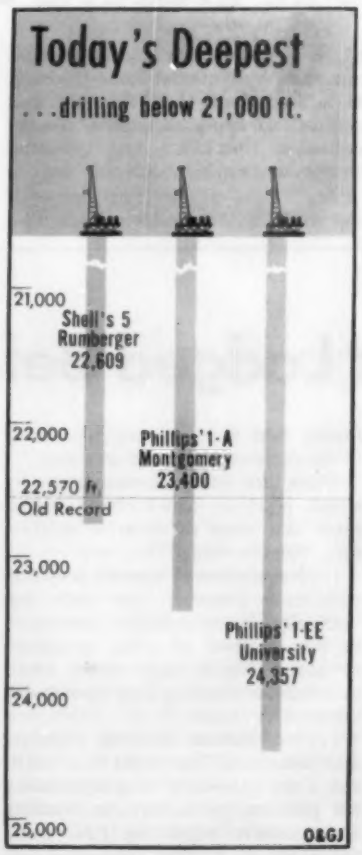
Shell reported no drilling troubles as the well moved downward at the rate of about 30 ft. per day through the Springer formation. Helmerich & Payne is the contract driller.

In Pecos County, Phillips' 1-EE University was still idle last week while awaiting delivery of new drill pipe before resuming its drilling and setting new records. The well holds the current depth record at 24,357 ft. and plans to go to 25,000 in search of the Ellenburger.

The 1-A Montgomery of Phillips, world's second deepest hole, has reached total depth of 23,400 ft. and is testing. It plugged back to 22,650 ft. after getting only a slight show of gas in the open hole below 23,000 ft. Perforations are now being made at 15-ft. intervals between 22,650 ft. and 22,880 ft.

Testing also continues on another deep Phillips well in Pecos County, the 1-A Harral. The 19,020-ft. well has had noncommercial shows at 18,950-19,000 ft., 18,790-18,900 ft., and 18,370-18,423 ft.

The three tests had 4,000, 20,000, and 59,000 cu. ft. of gas daily, respectively. The operators are planning to move back uphole for further tests. An earlier drill-stem test indicated commercial production at around 16,000 ft.



The 1-EE University is 8 miles east of Fort Stockton. The 1-A Montgomery is 30 miles southwest of the 1-EE University, and the 1-A Harral is 11 miles to the southeast.

NPC Plan Changed

by Secretary Seaton. Earlier demands on oil are relaxed.

THE GOVERNMENT and the National Petroleum Council may be nearer agreement on how NPC is to operate in the future.

Interior Sec. Fred A. Seaton last week eased some of his previous demands that control of the NPC be vested in a government official.

Seaton outlined three changes—he called them "clarifications"—in the requirements laid down by the Justice Department:

. . . **The industry chairman** normally would preside over council meetings, but the government co-chairman could take over whenever he deemed it necessary. In all other respects, the co-chairmen would have equal authority.

. . . **The NPC or its agenda committee** would have opportunity to propose revisions or reject items proposed for council consideration, but such actions would have to be approved by the co-chairman.

. . . **Meetings of the NPC** would be called by the chairman and co-chairman jointly.

"I hope these clarifications will be found satisfactory by the council," Seaton said in submitting them in a letter to Hines Baker of Standard Oil Co. (N. J.), one of the group negotiating with the government officials.

Seaton's letter is under study by the NPC negotiating committee, composed of Chairman Walter S. Hallanan, Baker, and J. Howard Marshall of Signal Oil & Gas Co. Their recommendations on the proposal will be handed to the full NPC membership.

Proration System Sought

A GROUP OF independent oil producers is proposing a market-demand proration system for Saskatchewan.

The proposal is for a voluntary system which apparently would include only medium-gravity crude produced in the province. The group pushing the plan has medium-gravity crude potential in the Weyburn area, southeastern Saskatchewan. Production potential there exceeds market demand by 25 to 50%.

The plan is to be submitted to the Weyburn Operating Committee in an effort to work out an equitable production schedule on a volutary basis.

If the operators refuse to accept the voluntary system, then the Saskatchewan government will be asked to set up a proration system similar to that in operation in Alberta.

watching WASHINGTON

Bertram F. Linz

• Consumer bloc in Congress may grow

WITH THE Eighty-Fifth Congress now a page in history, oil men can begin to wonder what the Eighty-Sixth Congress will look like.

The chances are it may look a little worse so far as oil matters are concerned. The November election is likely to add to the ranks of the consumer bloc, and some important friends of the industry won't be back next year.

Foreseeing this trend, backers of such measures as giving prior notice of a merger, limitation of the good-faith defense against price violations, and a national fair-trade law already are planning their 1959 strategy.

The recent Senate vote on a cut in the depletion rate was an eye-opener for many in the industry. There were 31 votes for it, compared with only 9 in 1951.

The fight on depletion will be renewed next year. Many predict the rate cutters will gain ground as new members from consuming areas join them. And a whale of a Treasury deficit which makes every tax dollar look bigger than ever will be a factor.

Any effort to revive the natural-gas bill will run up against the same consumer roadblock. And here the administration isn't likely to go all-out for the bill in view of past incidents which twice have stopped it cold.

• Shift to jet fuels cuts defense cost

THE DEFENSE Department spent less for oil in the last fiscal year but got more barrels of products for what it did spend.

This was due in part to lower prices. But more important, it emphasized a trend which will continue—the shift from aviation gasoline to jet fuels and the savings that result.

The Military Petroleum Supply Agency spent $1,194 million in the year ended June 30. That was a cut of $62.3 million from the preceding year.

But, for that money, it got around 263 million barrels of products, an increase of 8.9 million over the previous fiscal year.

Here is how the shift in fuel for military aircraft is making itself felt:

In fiscal 1957 the MPSA bought 44.8 million barrels of aviation gasolines at a cost of $350.4 million. Last year it bought only 39.6 million at a cost of $305 million.

Jet-fuel purchases amounted to 96.2 million barrels in 1957, costing $395.8 million. Last year it was 110.5 million barrels costing $446.4 million.

• Supreme Court has two top oil cases

THE U. S. Supreme Court will be back in business in 5 weeks.

Before the end of its term next June a number of issues important to the oil and gas industry are due to be settled. But interest right now centers on just two cases.

One case will decide whether the federal Government or the states will be the industry's landlord between the 3-mile and 3-league lines in the Gulf of Mexico.

The other will settle whether the method followed for years by the Federal Power Commission in dealing with pipeline applications for rate increases still holds good or must be scrapped.

The Gulf boundary suit will be argued 1 week after the court term starts. An opinion could be handed down before the end of the year. The Memphis case on gas rates probably will not be heard until next year, and a decision is many months in the future.

THIS FIVE-SPOT thermal-recovery project in California has shown that . . .

Fire Flood Works, But Costs Are High

A 3-YEAR thermal-recovery experiment in California has proved that a fire flood can recover large quantities of oil which otherwise would remain in the ground. But the price tag is apt to be pretty stiff.

General Petroleum Co. ran the $1-million experiment in Kern County's South Belridge field.

Here were the results:

. . . **Daily production** of the four producing wells occasionally hit 15 times the normal rate.

. . . **Within 18 months after ignition,** the fire flood produced about 50% of the oil in place around the four producing wells. Under ordinary conditions it would have taken 40 to 60 years to produce only 10 to 15%.

. . . **The operator,** however, ran into severe bottom-hole maintenance problems.

The method . . . General Petroleum acted as operator for itself and 11 other companies and used techniques developed by Magnolia Petroleum Co.

GP chose the South Belridge field because it is typical of the low primary recovery, heavy-crude fields common in California. Such fields usually are not suited for other methods of secondary recovery.

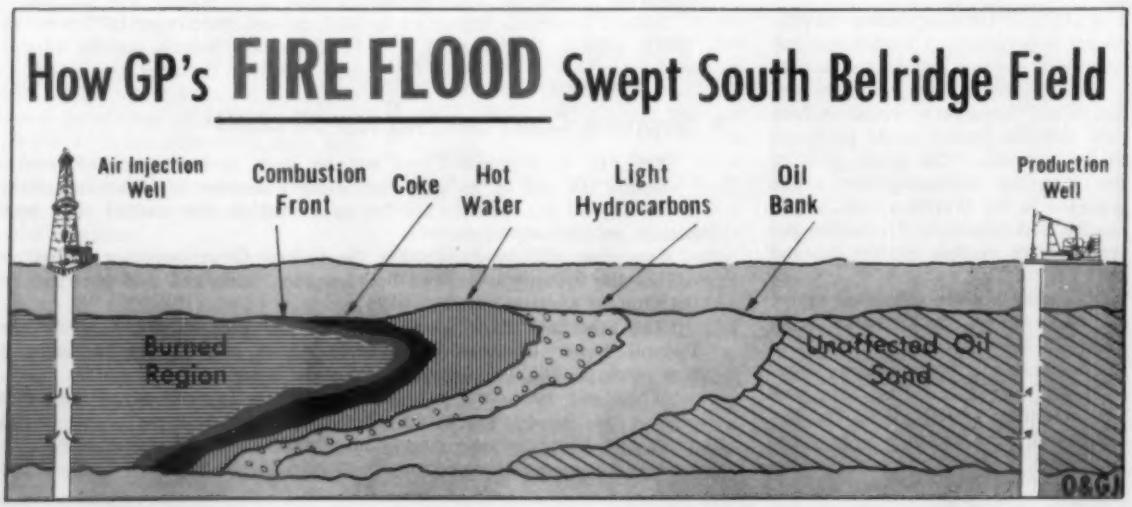
The experiment was designed to test the thermal-recovery technique in a near-commercial well-spacing pattern. GP used a 2½-acre five-spot pattern.

Four wells were completed in a 30-ft. interval of the Tulare sand at 700 ft. Placed on pump from October 1955 through February 1956, they averaged 20 bbl. daily for the 5 months.

On March 1, 1956, the operators started air injection. They used three compressors with a rated capacity of 3.5 million cubic feet daily at a maximum of 500 psi.

GP did not anticipate spontaneous combustion originally, but as 100° F. air was injected the operators noted the oxidation of the oil in the reservoir raised the temperature sharply.

Then, on June 15, just 3½ months



after the injection began, the oil in the reservoir ignited.

Three months later, fingers of the combustion front reached two of the four producing wells.

In the fire drive, only a small fraction of the otherwise unrecoverable oil was burned as fuel during the experiment. The lighter ends were pushed ahead of the fire front when their viscosity was reduced by both temperature and removal of heavy ends in combustion. The heavy residuum burned and produced some coke, which also burned (see drawing).

Production problems . . . Because of extreme corrosion in the hot producing wells, maintenance was difficult.

General Petroleum had to drill two replacement wells to continue production on a four-well basis. The replacement wells had stainless steel liners instead of normal steel liners, and service improved considerably.

As the combustion front approached the producing wells, water cuts increased, and water and oil emulsions became a serious problem. Frequent well stimulation work was necessary.

There were frequent well failures because of corrosion and high temperatures, and because of this oil production rates were erratic.

Prior to ignition, air injection had little effect on production. But within 2 weeks after ignition, production increased rapidly.

However, after the failure of the first two wells, production fell to its lowest point of 20 bbl. daily. Then, when the replacement wells were completed, rates climbed again to the maximum level and reached as high as 300 bbl. daily for short periods.

The cost . . . The over-all cost of $1 million for the experiment exceeded by several times the value of the crude produced.

But General Petroleum said the experimental costs were much higher than would be incurred ordinarily in a commercial fire flood.

The main costs consisted of drilling, repairing, redrilling and replacing producing well, drilling three core holes, operating three compressors, surface and subsurface maintenance, technical labor, buildings, instrumentation, and measuring and gaging devices.

GP has no plans at this time for further fire-flood experiments.

Joining with GP in the experiment were Continental Oil Co., Chanslor-Western Oil & Development Co., Esso Research & Engineering Co., Gulf Oil Corp., Honolulu Oil Corp., Ohio Oil Co., Shell Development Co., Sunray Mid-Continent Oil Co., The Texas Co., Tidewater Oil, and Union Oil.

Butadiene Capacity Up Again

THE NATION'S butadiene-manufacturing capacity, already far in excess of demand, has taken a sudden spurt with completion of a major expansion at the world's largest butadiene plant.

Another plant, which has been shut down several months because of low demand, soon will operate again.

The recently completed expansion is at the big Neches Butane Products Co. plant, Port Neches, Tex. A company official announced that the new unit was operating at design capacity of 100,000 tons per year.

New facilities increase the Port Neches plant capacity to approximately 320,000 tons annually.

Reconstruction work on older facilities at the plant has been delayed by a general strike of carpenters. With early settlement of the strike, the job is expected to be finished early next year.

The multimillion-dollar expansion job has been under way since the summer of 1956. Neches Butane Products Co. was organized by a group of oil companies during World War II to build and operate the plant for the federal Government. After the war, the plant was purchased by Goodrich-Gulf Chemicals, Inc., and Texas-U. S. Chemical Co.

Baytown readied . . . Humble Oil & Refining Co. has started "demothballing" its 65,000-ton-per-year butadiene plant at its Baytown, Tex., refinery. The unit is expected to be back on stream "at a reduced rate" in September.

Humble announced in April the plant would be shut down indefinitely. For some time before that, the unit had been operating at only about 15% capacity.

In announcing the decision to resume operations, Humble noted that butadiene inventories have dropped, and the market has improved slightly.

A recent study showed that the nation's butadiene plants were operating at about 56% of capacity (OGJ, June 2, p. 66). The low demand was attributed partly to the slump in automobile manufacturing and the resulting cut in production of tires.

Louisiana Gas Tax Might Grow

LOUISIANA GOV. Earl K. Long, elected to office on an economy pledge, is talking about another tax increase on natural gas.

A new law doubling the 1-cent per M.c.f. gathering tax, which went into effect August 1, is expected to be challenged in court by a group of Louisiana producers.

The governor has speculated publicly that the gas industry will be too smart to test the constitutionality of the new law.

"My better judgment tells me it won't be attacked," he told a news conference.

If the new revenue is tied up by court order, the governor figured, "the legislature would convene and put it (the tax) on at the wellhead at about twice what it now is."

The new tax increase is expected to total about $20,000,000 annually. The additional revenue has been dedicated to public schools, with the majority of it going toward teacher pay.

Gov. Long tried unsuccessfully to get the 1958 legislature to triple the gathering tax. As adopted, the tax increase will fall short of meeting the higher salaries voted for teachers in 1956.

The governor feels confident the legislature would add "at least an extra cent at the wellhead" to the present tax if spending of the extra revenue is held up by court action.

But Gov. Long says the "gas people" are smart enough to see the public-relations benefits to be gained by paying the new tax without protest.

If the gas people don't challenge the law, the governor said, "they'll get some favorable publicity for the future."

"If they do," he added, "they'll get a lot of unfavorable publicity."

FPC view . . . In Washington, the Federal Power Commission apparently isn't so confident that Louisiana producers will be willing to pay Gov. Long's price for good publicity.

The commission has suspended 513 rate changes reflecting the 1-cent increase in the state gathering tax. The increases total approximately $7,877,000 per year. Under the commission's order, most of the rate increases became effective, subject to refund, the day after the tax increase became due.

The FPC also announced that new certificates authorizing gas sales in Louisiana would require a refund "in the event the tax is invalidated by the courts."

Aurora Strike Settled

. . . when union votes to accept new contract. Workers get pay adjustment, overtime changes, in-plant training plan.

A 15-WEEK STRIKE at Aurora Gasoline Co.'s Trenton, Mich., plant ended last week when OCAW local 11-456 voted 153 to 122 to ratify a new contract.

The union balloting was conducted by a minister and priest.

The new contract provides:

. . . **A 4-cent wage adjustment** which OCAW says increases top operator rates to $3.47 hourly and common labor to $2.51. These figures, however, include money formerly paid in annual bonus.

. . . **Triple time** for overtime beyond 3 hours and 8 hours pay for workers called in but not used.

. . . **In-plant training program** which is part of the OCAW national bargaining campaign. This provides for in-plant training to qualify men for mechanical crafts. Joint union-management control of training and testing is provided.

Suits dropped . . . Aurora made a concession regarding 21 men fired and damage suits arising from alleged plant sabotage.

Aurora agreed to reinstate 7 of the 21 discharged after the strike began May 15. The company will arbitrate the matter of rehiring the 14 others.

Aurora also agreed to drop the damage suits it filed against 23 union members.

More disputes . . . The negotiations which resulted in settlement of the strike were carried on despite an injunction suit filed in Wayne County Circuit Court by four deposed local union officers.

Judge Victor Torganski declined to order the negotiations stopped (OGJ, Aug. 18, p. 113) after hearing both sides to the intraunion dispute.

The judge earlier had enjoined the four leaders from interfering with conduct of local affairs, but ordered the quartet reinstated as members of the union. National unicn officials had removed the men from office and expelled them from the union for violating union rules in conducting the wildcat Aurora strike.

The union squabble, however, is still not over. Still pending in Judge Torganski's court is a petition to set aside the election of delegates to the OCAW international convention opening September 22 at Long Beach, Calif.

Local Administrator C. S. Shamblen petitioned the court to hold a new election. Some local members claimed the election violated local by-laws. The voting resulted in the four deposed leaders—Floyd Rue, George Vitale, William Kelledes, and B. F. Henson—getting delegate posts. The fifth delegate was Robert Wright of the Socony Mobil group.

Also pending before the National Labor Relations Board is a petition filed by a new labor organization—Oil Workers National Union—asking bargaining rights at the Aurora plant. The OWNU claimed a large number of signed authorization cards have been obtained at the Aurora plant.

The OWNU is an independent union reportedly planning to raid the OCAW in the Detroit-Toledo area with a goal of 20,000 members.

Mideast Crisis Plan

needs airing by oil men. Justice approval required.

THE JUSTICE Department has been asked to lift its ban on intercompany discussion of plans to meet a Middle East oil emergency.

The draft of a proposed government plan was handed members of the Foreign Petroleum Supply Committee at a meeting called hurriedly in July by Interior Sec. Fred A. Seaton on the heels of the Iraq revolution (OGJ, July 28, p. 103).

The document would be the basis of a formal plan to be adopted if the flow of oil in the Middle East was interrupted, Seaton explained.

Seaton asked the oil men for their views and suggestions. But Asst. Atty. Gen. Hansen, head of the antitrust division, warned that they should not hold talks among themselves until clearance was given for action.

Committee members point out that without an exchange of views Seaton might receive 16 conflicting suggestions for improving the plan. But if the companies could talk it over, they could resolve these differences and come up with a single set of recommendations, over which there would be no time-consuming argument if events called for quick action.

Hansen has been asked to approve a meeting for this purpose. There would be no objection to the presence of antitrust officials to insure that talk did not spill over into forbidden fields, it was indicated.

Oil men point out also there are some holes in Seaton's draft plan that must be plugged. They would like to know, for instance, how a participating company could keep records of "contemplated" actions.

The emergency which Washington feared would follow the Iraq revolt did not arise. The United Nations now is trying to bring peace and stability to the Middle East. But officials are still concerned about the area, and the idea of preparing for trouble has not been shelved.

Pilot Cycling Plant Planned

PLANS ARE being made to construct a $3 to $3½-million pilot gas-cycling plant in the Windfall gas field near Whitecourt in Alberta.

The Alberta Oil and Gas Conservation Board has granted a construction permit for the plant, which will be operated by Canadian Fina Oils, Ltd. Other owners are Pan American Petroleum Corp. and Hudson's Bay Oil & Gas Co.

Gas to feed the plant will be taken from wells on the companies' 1,100,000-acre block in the West Whitecourt region, about midway between Pembina and Swan Hills. The plant initially will strip natural gasoline, butane, and propane from 30 million cubic feet of gas daily and return the dry gas to the producing zone.

The three companies have spent about $24 million in development of the area. The score so far is 18 successful wells and 11 dry holes.

Florida Line Work Starts

COASTAL Transmission Corp. wasted no time in starting construction on the Texas-to-Florida gas pipeline after completing initial financing for its portion of the line.

Work started last week on an 8-mile section of a 6-in. gathering line from East Corpus Christi Bay field in Southwest Texas. Altgelt Construction Co., Inc., Corpus Christi, contractor for the project, was at work less than a week after financing was approved (OGJ, Aug. 25, p. 46).

Actually, this is not the first work on the project. Another small segment of gathering line had been laid more than a year ago in Hidalgo County, Texas (OGJ, June 24, 1957, p. 106).

First contracts for mainline construction are expected to be let in about 2 weeks. Eastern portion of the system will be built and operated by Houston Texas Gas & Oil Corp. Both it and Coastal are subsidiaries of Houston Corp.

Record Tow of LPG Tanks Starts at Miami

A STRAW in the wind indicating the growth ahead for LPG was seen at Miami, Fla., recently.

A possible record tow for LPG tanks started there en route to Puerto Rico. The sea train consisted of a tug pulling four 50-ft., 30,000-gal. tanks past the Miami skyline.

Tropical Gas Co. of Miami decided in favor of the 1,100-mile haul by tug for economy reasons. It figured the tow could save 40 to 50% over shipment by freighter from the northeastern seaboard.

The tanks were shipped by rail to Miami from Milton, Pa., where they were constructed by American Car & Foundry division of ACF Industries.

PROCESSING BRIEFS...

Continental Oil Co. has expanded its "technical job progression plan" to the manufacturing and engineering departments. The program provides new advancement opportunities for men who prefer to stay in a technical field rather than assume administrative or supervisory jobs.

The company has created four new job titles in the technical field—senior consultant, senior advisor, consultant, and advisor. A similar program was adopted last month in Conoco's research and development department.

Southland Co. has shut down its refinery near Yazoo City, Miss. The 5,500-bbl. plant will remain closed indefinitely. The company recently filed application for an oil-import quota.

Richfield Oil Corp. has a new 3,500 B/SD Udex unit on stream at its Wilmington, Calif., refinery. The process unit was licensed, designed, and engineered by Universal Oil Products Co. of Des Plaines, Ill.

Standard Oil Co. (Ind.) has licensed its process for making aromatic acids to Imperial Chemical Industries, Ltd., of England. Standard officials term the process, which uses hydrocarbon raw materials, the most economical known for production of a number of aromatic acids (OGJ, Dec. 3, 1956, p. 62).

ICI will use the process to make about 30 million pounds per year of terephthalic acid in a new plant at its Wilton Works near Middlesbrough, England. The new plant is to begin operation in 1960.

Sinclair Refining Co.'s Wellsville, N. Y., refinery is being dismantled. The plant was shut down last May because of the decline of Pennsylvanian crude supply. It was sold last month to J. R. Watt and Arthur Finston, both of Tulsa, who are conducting the dismantling operation under the name of New York Refinery Project.

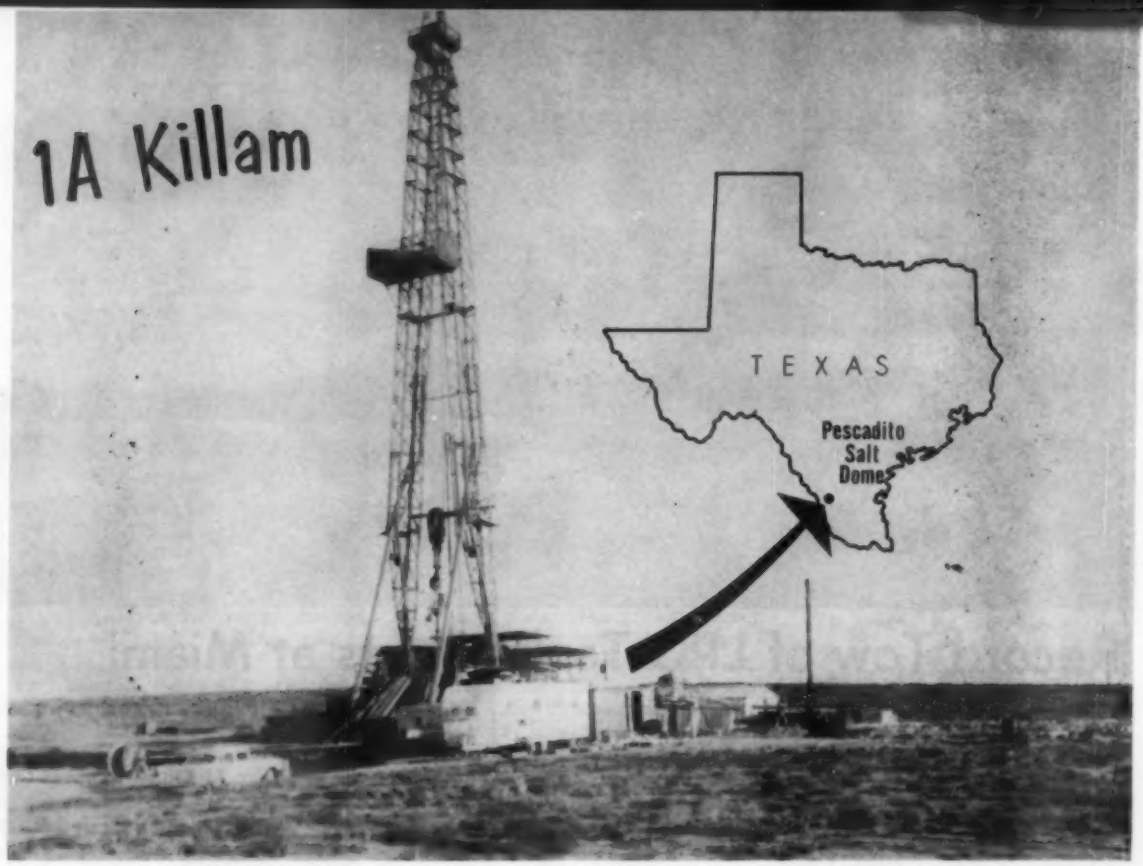
Nominations for Alberta crude have dropped again. Nominations for September totaled 287,400 bbl. daily, down 11,632 bbl. from August. Imperial Oil, Ltd., cut its nominations to 96,130 bbl. daily—down 30,170—principally because of a refinery turnaround at Sarnia, Ont.

British Columbia and Manitoba refiners increased their nominations to take up some of the slack. Four U. S. refiners submitted nominations totaling 23,500 bbl. daily, down 1,400 bbl. from August.

Also for Refiners . . .

IN THE NEWS: New import-control plan apparently will give all refiners chance to import crude based on their throughput (p. 101) . . . Nation's butadiene capacity, already exceeding demand, takes another jump with expansion of world's largest plant (p. 107) . . . Union members accept new contract, ending 15-week strike at Aurora's Trenton plant (p. 108) . . . Oil-company profits in first half reveal depth of the recession (p. 113) . . . LPG sales run contrary to trend—they jump instead of slump (p. 114) . . . Gulf claims its new Mississippi River terminal below New Orleans is the fastest oil-loading terminal in the U. S. (p. 118) . . . New company plans to build Jamaica's first refinery (p. 124).

PLUS THESE TECHNICAL REPORTS: Petrochemicals on the move (p. 126) . . . Annual petrochemical survey (p. 129) . . . Visual aids speed turnaround (p. 159).



Pescadito Test Is Tough Operation

OTHER WELLS may be getting the headlines for depth, but Ginther, Warren & Co. has a well that outdoes the deepest wells in many respects.

The company's 1A Killam in Webb County, Texas, has drilled:

... **More than 3,300 ft.** of hole with ultra-heavy (more than 19 lb. per gal.) mud.

... **More than 2,500 ft.** of "slim" hole (4⅞-in.) below 16,500 ft.

... **Some 1,300 ft.** of hard shale below 13,000 ft. with a single diamond bit.

... **Formations with** temperatures above 400° F.

The 1A Killam is not the deepest hole ever drilled. It's not the hottest. The mud isn't the heaviest ever used and the hole diameter isn't the smallest. But, the factors of depth, heat, high mud weight, and small hole combine to make this operation one of the toughest in the history of oil well drilling.

At its present depth of 19,128 ft., the 1A Killam is the deepest ever drilled on the Texas Gulf Coast and Southwest Texas.

With bottom-hole temperature above 400° F., it is the second hottest well ever drilled anywhere. The hottest was the number 1 Killam, drilled by the same company last year only 1½ miles away.

Muds weighing more than 20 lb. per gal. have been used to kill wild wells many times in the past. But, it's unlikely that a mud weighing more than 19 lb. per gal. was ever used to "make hole" for more than a few feet.

There are no records about how deep small-diameter holes have been drilled. But, it's certain that the 2,500 ft. of 4⅞-in. hole drilled below 16,536 ft. in the 1A Killam is a record of some sort.

One mark the company is happy not to be shooting at is the cost record. R. E. (Bob) Keen, manager of drilling and production, estimated it is costing slightly less than $30 a foot to drill the well.

Geologists in the dark . . . Besides being a headache to drill, the 1A Killam has been a real puzzle to exploration people.

Since the well passed 14,000 ft., no one has been able to say for sure just what formations were being drilled. There being almost no deep wells nearby, geologists have had to try correlations with wells as far as 150 miles away in South Texas or across the Rio Grande in Mexico.

Location is on the Pescadito dome. This "text-book" structure has been known for many years. It's estimated to be as much as 15 miles long and 9 miles wide. However, it has had a long history of dry holes, the deepest a 13,700-ft. wildcat drilled in 1950. And, when Ginther, Warren & Ginther spudded their first wildcat there in 1956, Pescadito had never produced.

Ginther, Warren & Ginther were looking for the Edwards lime, a prolific producer in other parts of South Texas. They expected to find the Edwards at 17,000 ft., but the well drilled into a salt plug at 15,070 ft. And, for the first time, it was evident that Pescadito is indeed a deep-seated salt dome.

The Ginther, Warren & Ginther 1 Killam was dry. However, it provided the leads that brought about later discovery of gas production in nearby shallow wells. The company, in association with Michel T. Halbouty and Gulf Oil Corp. now has two excellent gas producers in the Wilcox formation at 6,000 to 7,000 ft.

Still determined to find the Edwards lime, the three companies

spudded the 1A Killam on the flanks of the dome. During drilling, Noble Ginther left Ginther, Warren & Ginther firm and the project continued under the name of Ginther, Warren & Co.

High-Pressure gas . . . The 1A Killam went routinely to 10,015 ft. where 10¾-in. casing was set. Below that drilling went rapidly.

However, at 14,004 ft., the bit hit a high-pressure gas zone which unloaded the hole full of 17.8-lb. per gal. mud. It took 2 days and 19.2-lb. mud to kill the flow. And, when the well was brought back under control, the drill pipe had stuck. So, the hole had to be sidetracked.

When the sidetracked hole reached 13,193 ft., the operators ran a 7⅝-in. liner. This was necessary to support the high mud weight needed to drill the high-pressure zone at 14,000 ft. Thus, at 13,193 ft. began a run of 3,343 ft. during which mud weight at no time was less than 19.2 lb. per gal. And, much of the time, mud weight had to be kept at 19.5 lb. per gal. At any attempt to lighten up the weight, the mud immediately became badly gas cut.

Sloughing shale . . . Most of the interval drilled with the ultra-heavy mud was a hard, slate-like shale.

Fortunately, it was not a bad "mud-making" shale. That is, the drilled particles did not disperse in the mud and cause a big increase in viscosity as some Gulf Coast shales do. Fortunately, also, the hole walls stood up against the high weight and there was no loss of circulation.

However, the shale was extremely bad about sloughing into the hole. After every trip, the hole filled badly. A lot of reaming and redrilling was necessary. It was even necessary to log through the drill pipe because of the sloughing. To help overcome the problem, Ginther, Warren & Co. went to diamond bits. These stay on bottom much longer than rock bits. As a result, sloughing particles could be circulated out of the hole almost continuously. One of these bits drilled 700 ft., was pulled from the hole, re-run without being reworked, and drilled another 600 ft. This made 1,300 ft. from a single diamond bit.

The mud was so heavy that it actually floated the shale particles. A piece of shale thrown into the pits would not sink. And, fist-size chunks of shale frequently came tumbling out of the flow line.

Temperature climbs high . . . Ginther, Warren & Ginther's first Pescadito test drilled the highest formation temperatures ever recorded—460° F. at 14,552 ft.

For that reason, the 1A Killam had to be prepared for equally high temperatures. So, at an early date, the mud system was changed over to a temperature-resistant, low-sodium surfactant mud.

This mud carries about 3,800 p.p.m. of chloride and viscosity of about 75 seconds. Initial and 10-minute gels have run about 15 and 25 gms. In spite of these seemingly high gels, it has never been necessary at any time to stop a trip into the hole for the purpose of breaking circulation.

Temperatures in the 1A Killam have consistently run lower than those in the nearby number 1 Killam well. However, at point of last measurement, 18,800 ft., the 1A Killam showed bottom-hole temperature of 410° F., making it the second hottest hole ever drilled. Ginther, Warren & Co. officials feel that actual static bottom-hole temperature is probably in excess of what has been measured when running logs.

Since the well drilled past 14,000 ft., flow-line temperatures have regularly run higher than 160° F. Many times it has reached 180° F.

As a result of the high temperature, no directional survey has been run on the well since 12,500 ft. The film used in surveying tools melts. And, it hasn't been possible to use string shots during fishing jobs. They won't work at the high temperature. Drill-pipe protector rubbers disintegrate and come off after only a few trips into the hole. Pistons, packing, and valves on the mud pumps last only a few hours.

And, because of the high temperatures and pressures (above 3,000 psi. much of the time) two rotary hoses failed in a 2-day period. These had to be replaced by a steel hose.

Second liner helps . . . When well depth reached 16,356 ft., the bit was drilling in a dense lime. Apparently the worst of the shale section had been passed. So, a 5½-in. liner was run to bottom. Because of the depths and pressures the liner was extra heavy —20-lb. per ft. P-110 pipe.

While it didn't help the temperature problem, the liner did case off the

The JOURNAL Said . . .

50 years ago

September 6, 1908

A detailed description of the 8-in. rifled pipeline constructed by the Associated Pipe Line Co. of San Francisco from Kern River field to tidewater near Port Costa, a distance of 282 miles, is given by The Oil Industry of Los Angeles as follows:

The pipe is what is known as rifled pipe, the pipe being scored or rifled with corrugations about ⅛-in. deep, each corrugation making a complete revolution in 10 lineal feet. Ten per cent of water is introduced with the oil, cold, and the centrifugal force, due to the riflings in the pipe, causes the water to remain on the outside, where it forms a thin film between the oil and the sides of the pipe, which naturally greatly reduces the friction. It has been demonstrated that between 17,000 and 20,000 bbl. of net oil of 14° gravity can be pumped 24 miles in 24 hours under a working pressure of about 750 psi. This result is impossible to obtain with any present known system of pumping hot oil.

A St. Louis genius proposes to light Europe with natural gas from Oklahoma. What's the scheme, old boy? Going to pipe it under the ocean, ship it over in tanks, or inhale it on this side and hand it to 'em in interviews on the other side? More details, please.

25 years ago

August 31, 1933

Average price of 36°-gravity crude in the Mid-Continent area during the past 5 years has been $1.08 a barrel and, according to the spirit of the new oil industry code, the new price, under the code should be at least that figure.

Even that price will not permit much of a profit to the industry as no one, by any stretch of imagination, can say the oil business showed a great profit during the past 5 years. . .

President Roosevelt today appointed Secretary of the Interior Harold Ickes as administrator for the oil industry.

Never in the history of the Gulf Coast, or perhaps in any other district, has such an intensive or mass wildcat drilling development program been undertaken as that under way in the Louise district of Wharton County. . . The center of this drilling activity is Pure Oil Co.'s 8,000-acre block, which lies just south of the town of Louise on the Jackson County line.

10 years ago

September 2, 1948

Current production in the Middle East is only slightly below that of Venezuela, and it is considered probable that it will exceed that of Venezuela before the end of 1948. . . Venezuela had a daily average production of 1,338,000 bbl.

A cooperative arrangement whereby the Bureau of Mines will supply oil shale and shale oil for tests and experimentation by 10 organizations which, in return, will make available to the bureau full information on the results of their work was announced this week by Director James Boyd.

California's oil and gas production will reach its peak next January and then begin a steady decline. This was the prediction last week of Roy M. Bauer, gas supply supervisor for Southern California Gas Co.

sloughing shale and the high-pressure gas zone had blown out at 14,000 ft. As a result, it was possible to lighten the mud weight to 17.6 lb. per gal. This fluid was 2 lb. lighter than that used before, but it was still an extra-heavy mud by most standards.

To work in liner, Ginther, Warren & Co. picked up 5,800 ft. of 2⅞-in. drill tubing for the bottom of the drill string. Above this is 6,500 ft. of 3½-in. drill pipe with slim-hole tool joints. The remainder of the string is 4½-in. pipe. This combination gives the possible hydraulics in the deep, small-diameter hole.

Drilling continued below the liner with diamond bits as it had before the liner was set. Bit diameter below the liner is 4⅛-in. The diamond bits make from 5 to 7 ft. per hour and stay on bottom as long as 90 to 100 hours. The drillers make "short trips" every 24 to 36 hours to make certain that all solids are being circulated out of the hole.

There was one fishing job in the 4⅛-in. hole. A tool joint washed out and parted. However, the job was cleaned up by running a new joint and screwing into the top of the fish.

Crude Prices Cut

by three buyers in Texas, Louisiana, and Mississippi.

THREE MORE major buyers have posted lower prices for crude in parts of Louisiana, Texas, and Mississippi.

Shell Oil Co. cut 10, 15, and 25 cents a barrel from the prices in 21 Louisiana fields and Clam Lake field of Texas. It discontinued postings for 10 other fields.

The 25-cent cut was for Happytown field crude. The 15-cent cuts applied to West Lake Verret, Gibson, Northeast Gibson, West Hackberry, Black Bayou light, Chalkey, Turtle Bayou, and East Moss Lake fields. The 10-cent cuts applied to Good Hope, Burtville, South Pass Block 24, South Pass Block 27, La Pice, St. Gabriel, Weeks Island, White Castle, Iowa light, Main Pass Block 69, Black Bayou heavy, and Clam Lake fields.

Indiana Oil Purchasing Co. cut posted prices 5 and 10 cents in three Louisiana fields. It also put into effect a 2-cent per degree penalty for crude above 45° gravity in some areas of Arkansas, Louisiana, and Texas.

The 10-cent cut was made for Ora, La., crude. Crude from Colquitt and Mount Sinai, La., was reduced 5 cents.

Pure Oil Co. reduced Carthage Point, Miss., crude by 10 cents a barrel and applied the 2-cent penalty on gravities above 45°.

Flood Picture Bright

. . . at West Texas' Cogdell field. Two-year operation has brought improved reservoir pressure and gas-oil ratios.

OPERATORS in West Texas' big Cogdell field now are savoring a bit of fruit from seeds planted 3 years ago in the way of a big 15,000-acre field-wide water flood.

The Cogdell Canyon Reef Unit, formed July 1, 1955, to start and operate the flood, was able to show sufficient response to injection this summer to garner a substantial MER hike from the Texas Railroad Commission.

The added oil the unit is now producing is a portion of 60,000,000 bbl. of extra oil the field's Canyon Reef pay is expected to yield due solely to the flood.

Flood performance so far has been excellent and closely parallels the unit's initial expectations.

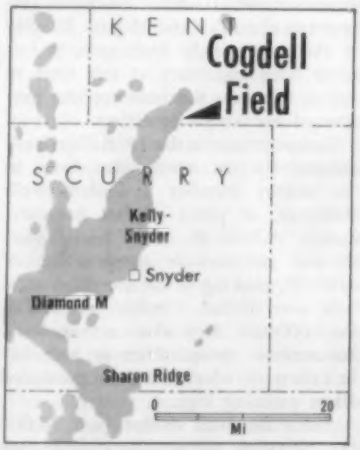
Both reservoir pressure and gas-oil ratios have shown pronounced, favorable reaction to injection.

Original reservoir pressure of the pay was 3,120 psi. when the field was discovered in December 1949. It fell to a low point of 1,254 psi. in September 1956 despite a field-wide, dispersed gas-injection program operated from April 1953 to August 1955 and crestal injection thereafter.

Field pressure now is back up to 1,459 psi. and is continuing to climb. The field's average GOR, dangerously near the penalty figure prior to water flooding, now has receded to a respectable 804:1.

Steady expansion . . . First water at Cogdell was injected into the 6,800-ft. reef in April 1956 following commission approval of the unit and flood effective July 1, 1955.

The unit, operated by The Texas Co., steadily hiked injection volume to full-scale proportions early last year.



Since then, roughly 50,000 bbl. of water has been pumped daily into the reef's 108 ft. of net pay through a ring of input wells around the field's periphery.

The water is fresh water taken from the underflow of the Double Mountain Fork of the Brazos River in Kent County through about 15 miles of concrete-coated pipeline. The unit has a permit from the Texas Board of Water Engineers to take up to 3,525 acre-ft. a year from the sand and gravel deposits underlying this stream for injection at Cogdell.

The big project now boasts 377 wells. Of these 329 are producers, 46 are water inputs, and the remaining 2 are wells still injecting gas on the crest of the structure. Of the producers, 106 are flowing, 128 are on artificial lift, and 95 are shut in.

Since its discovery to July 1, 1958, Cogdell produced 53,663,000 bbl. of oil. Its production in June (on only an 8-day producing schedule) was 290,312 bbl.

The unit estimates that the field would have produced by primary means only about 135,000,000 bbl. of oil. The water flood, it thinks, will hike this take to about 195,000,000 bbl.

Operators in the field besides Texaco are Pan American Petroleum Corp., D. D. Feldman Oil & Gas Co., Humble Oil & Refining Co., and Chapman & McFarlin Producing Co.

Chain complete . . . Cogdell was the last link in a chain of unit pressure-maintenance projects in the prolific Canyon Reef fields extending south to north through Scurry County and well into Kent County.

The units are the Sharon Ridge Canyon, the Diamond "M," the huge SACROC unit in Kelly-Snyder, Cogdell, and Salt Creek, which is north of Cogdell.

Together, they take in nearly 90,000 acres and 2,600 producing wells. And they will recover considerably more than a billion barrels of oil over and above primary production.

The bulk of the added oil, and of the wells and acres, too, is claimed by the mammoth SACROC project in Kelly-Snyder. Its statistics: 795,000,000 bbl. of secondary oil, 50,000 acres, and 1,238 wells.

Oil Profits Reveal Recession's Depth

JUST HOW FAR oil-industry activities skidded in the first half of the year before the upturn set in is revealed in a study of the profits reports of 48 oil companies.

The study, made by Carl H. Pforzheimer & Co. of New York, emphasized two facts:

...**Net income** of the companies dropped 35.5% during the first half of 1958 compared with the same period in 1957.

...**The drop in earnings** hit all branches of the industry.

Aggregate income of the 48 companies was $1,388,586,000 compared with $2,152,931,000 in the first 6 months of 1957. The decline for the first quarter was 32.2% and for the second quarter 39%, which marked the bottom of the 1957-58 downswing.

The Pforzheimer report emphasized that all segments of the industry shared in the first-half doldrums.

Producing companies suffered from cutbacks in crude output. The pinch particularly was felt in Texas where only 56 allowable producing days were recorded in the 1958 first half while the same period in 1957 had 96 producing days.

The refining and marketing companies at the same time were squeezed severely by lower refined product prices and unchanged prices for crude. This pinch showed up clearly in two yardsticks:

...**Index of wholesale prices** averaged 113.7 during the first 6 months of the year. It stood at 128.8 for the same period last year.

...**Refiners gross margin** or the spread between weighted averages of crude and refined products prices dropped from an average of $1.15 per barrel to $0.72 per barrel between the two half-year periods.

The upturn . . . The quarter which saw the low point in oil operations also was the turning point for economic improvement, according to the Pforzheimer staff.

Heavy liquidation of inventories achieved through cutbacks in crude production and refinery runs during the first 6 months brought about some improvement in product prices and allowed crude production rates to start climbing.

The report stated that any large seasonal increase in winter demand will have to be met by greater new supply since current crude inventories are considered near minimum working levels.

A Look at First-Half Oil Earnings

	First half 1958		First half 1957	
	Net income	Per share	Net income	Per share
Amerada	$9,850,007	$1.56	$15,646,953	$2.48
Anderson-Prichard	1,377,089	0.71	2,819,633	1.59
Argo Oil	2,421,065	1.23	2,822,455	1.44
Arkansas Fuel	3,322,887	0.87	3,924,934	1.03
Ashland*	3,780,220	0.51	8,575,448	1.32
Atlantic	7,667,011	0.78	25,292,821	2.74
British American	6,142,000	0.33	12,660,000	0.68
Champlin	2,864,591	0.66	5,341,557	1.29
Cities Service	†24,618,594	2.34	36,315,490	3.52
Continental	20,208,000	1.03	23,714,000	1.21
Creole	160,913,000	2.07	221,648,000	2.86
Getty	7,980,390	0.48	12,962,122	0.80
Gulf	115,736,602	3.72	‡201,754,510	6.48
Honolulu	5,585,701	1.49	7,616,233	2.03
Humble	57,182,000	0.79	116,135,700	1.62
Imperial	24,153,000	0.77	37,662,000	1.19
International Pet.	12,900,000	0.89	23,300,000	1.60
Louisiana Land	8,860,687	0.99	10,502,804	1.17
Midwest Oil Corp.	3,347,413	1.32	3,612,245	1.42
Monterey*	1,357,641	0.75	1,496,418	0.83
Ohio	15,086,974	1.15	22,232,652	1.69
Phillips	36,411,576	1.06	53,398,637	1.55
Plymouth	1,520,429	0.61	4,405,039	1.78
Pure	10,675,000	1.24	19,012,000	2.21
Quaker State	811,288	0.98	958,160	1.16
Richfield	10,409,590	2.60	13,704,817	3.43
Shamrock*	4,713,092	1.37	4,620,421	1.34
Shell	45,651,602	1.51	75,320,849	2.49
Signal	5,660,000	1.29	6,136,000	1.40
Sinclair	24,806,984	1,62	44,848,197	2.93
Skelly	10,548,955	1.83	19,933,551	3.46
Socony Mobil	67,500,000	1.40	126,800,000	2.70
South Penn	1,630,503	1.03	3,127,881	1.97
California Standard	116,735,443	1.85	136,328,987	2.16
Indiana Standard	52,423,067	1.47	82,576,935	2.33
Kentucky Standard	6,301,000	2.42	6,332,000	2.43
Jersey Standard	291,000,000	1.43	463,000,000	2.35
Ohio Standard	§11,435,786	2.29	12,623,009	2.53
Sun	11,559,585	1.01	25,187,436	2.34
Sunray Mid-Continent	19,251,419	1.01	¶33,866,869	1.85
Superior*	8,294,915	19.65	11,373,354	26.93
Texas	138,535,542	2.37	165,145,982	2.83
Texas Gulf	1,617,000	0.40	3,665,700	0.91
Texas Pacific	2,352,833	0.65	3,949,056	1.10
Tidewater‖	279,000	—0.09	21,569,000	1.52
Union	11,456,744	1.46	16,727,071	2.13
Wilcox	369,291	1.22	534,623	1.81
Woodley	1,280,936	1.56	1,749,074	2.22

*Fiscal half corresponding to calendar half year. †Includes nonrecurring profit of $6,551,428 or $0.62 per share. ‡Includes nonrecurring profit of $30,685,701 or $0.99 per share. §Includes nonrecurring profit of $3,081,044 or $0.64 per share. ¶Includes nonrecurring profit of $9,031,970 or $0.52 per share. ‖Tidewater netted $279,000, but paid a preferred stock dividend of $1,497,000 leaving a deficit of $1,218,000 or 9 cents a share for common stock.

LPG Sales by Products

(Thousand gallons)*

Year	Butane	Per cent of total	Propane	Per cent of total	Butane-propane mixture	Per cent of total	All other mixtures†	Per cent of total	Total LP-gas	Per cent increase
1953	671,320	13.6	2,832,495	57.4	1,428,194	29.0	.....	.....	4,932,009	10.2
1954	765,826	14.9	2,968,312	57.9	1,391,395	27.2	.....	.....	5,125,533	3.9
1955	724,334	11.8	3,260,571	53.3	1,428,938	23.3	708,875	11.6	6,122,718	19.5
1956	888,545	13.4	3,626,189	54.6	1,160,017	17.5	‡961,012	14.5	6,635,763	8.4
1957	1,117,748	16.1	4,009,144	57.8	934,183	13.5	§878,046	12.6	6,939,121	4.6

LPG Sales by Uses

(Thousand gallons)*

Year	Domestic and commercial	Chemical	Synthetic rubber	Internal com-bustion	Industrial	Refinery fuel†	Gas mfg.	Used in the secondary recovery of petroleum	All other	Total
1953	2,479,180	967,427	390,501	498,238	348,517	.....	222,430	.....	25,716	4,932,009
1954	2,626,808	1,050,239	307,735	547,204	375,121	.....	191,932	.....	26,494	5,125,533
1955	2,801,379	1,493,177	406,210	651,821	423,431	101,033	213,760	.....	31,907	6,122,718
1956	3,001,021	1,600,604	418,101	773,471	438,916	142,590	212,293	.....	48,767	6,635,763
1957	3,067,070	1,732,338	418,189	805,056	441,474	122,405	231,155	68,557	52,877	6,939,121

*Includes LRG. †Not reported separately prior to 1955. ‡Includes 36,088,000 gal. of isobutane. §Includes 26,721,000 gal. of isobutane.

LPG Sales: Jump Instead of Slump

THE ECONOMIC slump which curbed domestic demand for other petroleum products has had little effect on LPG.

While the over-all domestic demand for petroleum products just barely held its own last year, LPG was being sold at a record clip. New records probably will be set again this year and next.

Sales of LPG in 1957 climbed to nearly 7 billion gallons. This was a gain of 4.6%, compared with the previous year's gain of 8.4%. Yet, when compared with the tiny .2% gain for all products in 1957, LPG's growth looks good.

One big factor in the continued upward trend is the industry's new ability to store LPG the year round in comparatively cheap underground storage caverns. Underground storage capacity jumped 35% last year and is likely to rise sharply again this year.

The breakdown . . . The latest LPG survey by the U. S. Bureau of Mines shows that the biggest market for LPG is still domestic and commercial space heating.

This use accounts for more than 44% of the total, but the rate of gain for this market slowed down to 2%, compared with a 7% gain the previous year.

Synthetic rubber and chemical plants used nearly 31% of the total. Deliveries to chemical plants for use as raw materials and solvents was up 8%, while LPG for synthetic rubber components showed no gain.

The biggest sales increase last year was in LPG sold to gas companies for use in gas manufacturing. This totaled 231,155,000 gal., an increase of 9%. Use of LPG as fuel at refineries fell 14%.

The growing popularity of LPG as a secondary-recovery tool caused the bureau to include this market in its annual survey for the first time. LPG used in miscible-phase displacement projects accounted for 1% of all domestic sales, or 68,557,000 gal.

The biggest share of LPG sold last year was propane, accounting for nearly 58% of the total sales. Both propane and butane sales increased, but butane-propane and all other mixtures decreased.

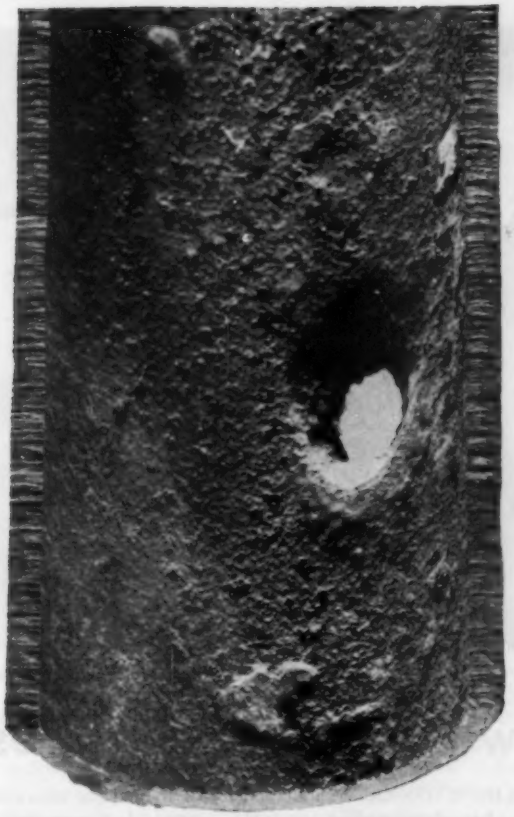
LPG exports rose 6% to a total of 190,603,000 gal. Most of this went to other countries in North America.

LPG Use in Secondary Recovery in 1957

(Thousands of gallons)*

District—	Butane	Propane	BP Mix	Total
No. 1 (East Coast)	.....	.....	.....	.....
No. 2 (North Central)	1,321	2,432	.....	3,753
No. 3 (Southwest)	5,097	41,250	2,041	48,388
No. 4 (Rocky Mountains)	2,749	2,188	.....	4,937
No. 5 (West Coast)	9,092	2,387	.....	11,479
Total	18,259	48,257	2,041	68,557

*Includes LRG.



Sulfate reducing bacteria, cause of corrosion that penetrated this brine line, can now be controlled. New Nalco 322 prevents this attack, in brine, as effectively as does Nalco 321 in fresh water systems.

ANOTHER NALCO SYSTEM PLUS . . .

In Waterflooding: Strict Control of Sulfate-reducing Bacteria In Brine as well as Fresh Water Systems.

STOPS ➤ **Pitting Corrosion**
Iron Sulfide Sludge Formation

Controlling sulfate-reducing bacteria in fresh or brine water injection systems is an integral part of Nalco treatment for waterflooding . . . along with efficient clarification, scale prevention and corrosion control.

Effective, *economical* control of sulfate-reducing bacteria in waters of high chloride content is a new development in water treatment practice . . . one you should certainly investigate if sulfate-reducer control costs are running high — or effectiveness is less than excellent.

Write or call for action today. Ask about new Nalco 322.

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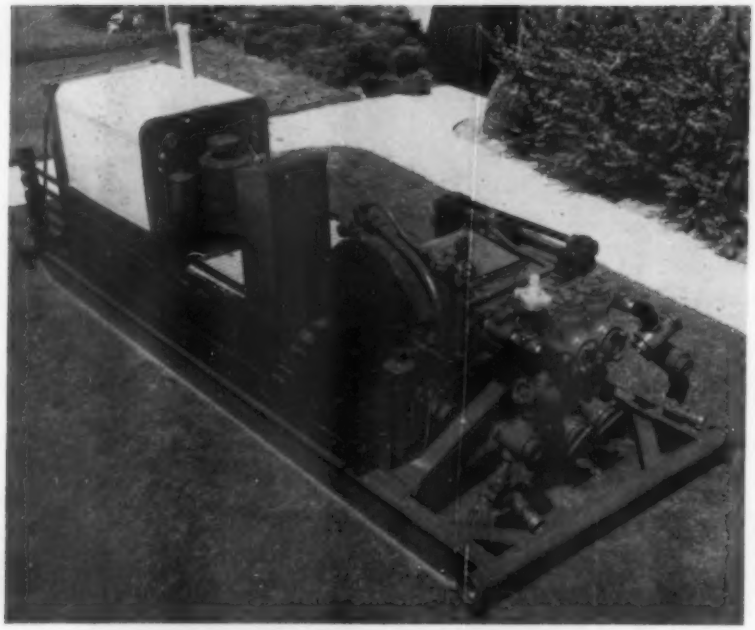

FOR DEEP WELLS, Halliburton engineers come up with . . .

New Pump for High Pressures

HALLIBURTON Oil Well Cementing Co. has developed a portable, high-pressure pump which promises successfully to meet drilling or production needs arising in deep wells.

Capacity of the pump is about 21 g.p.m. at a sustained pressure of 20,000 psi., or approximately 250 hydraulic horsepower.

The pump is a modification of Halliburton's HT-400 line, which has been used successfully on cementing and fracturing jobs.

Halliburton engineers developed the new pump to meet a specific current need. They felt that service operations on deep wells to be drilled in the future would require pumps capable of handling much greater pressures.

Some Gulf Coast wells already are producing from high-pressure reservoirs and in case of trouble may require the high-pressure pumps.

Two of the units have been completed and are located on the Gulf Coast of Louisiana, site of most of the countrys' high-pressure wells.

The unit . . . The pump is a skid-mounted package unit which allows it to be moved quickly to any location.

Equipment includes a 335-hp. diesel engine, torque converter, and full power-shifting transmission. The whole unit weighs 17,400 lb., is 6½ ft. wide, and 20 ft. long.

The engine is equipped with a special radiator. It permits the cooling of the torque converter and transmission oil, the pump's lubricating oil, and the engine coolant. Another feature is an air starting system, for which a small gasoline-driven compressor and storage tank are mounted on the skid.

The fluid end of the pump uses the same basic steel forgings as others in the HT-400 series but has been modified for extreme-pressure applications.

Because of the extremely high pressures involved, all the pipe used in the unit is heat-treated alloy steel. All pipe fittings, unions, and swivel joints also are specially designed for 25,000 psi. working pressure.

Two pumps can be used in parallel to double the volume of fluid pumped.

Texaco Finishes Atomic Lab

THE TEXAS CO. has completed an industrial radiation lab at its Beacon, N. Y., research center. Texaco officials said it is equipped with the largest single shipment of radioactive cobalt-60 ever made to an industrial installation.

It also houses two other nuclear-radiation sources, 6 to 10-million-volt linear electron accelerator and a 3-million-volt positive-ion Van de Graaff generator. The three facilities provide the four basic nuclear-radiation forces —electrons, positive ions, gamma rays, and neutrons.

Cycling Program

for 27 reservoirs in four fields planned by Humble.

HUMBLE OIL & Refining Co. has applied to the Texas Railroad Commission for permits to cycle gas from 27 reservoirs in Southwest Texas where the company plans to construct the world's largest cycling plant.

Hearing on the applications has been set for September 9.

Construction of the gas-processing and cycling facilities—to be known as the King Ranch plant—is expected to begin in the near future. As originally announced, the plant would be designed to handle about 750,000,000 cu. ft. of gas and extract some 25,000 bbl. of liquid products per day (OGJ, June 10, 1957, p. 63). The plant is to be near Humble's Seeligson compressor plant in Kleberg County.

Humble's applications cover proposed cycling operations in Borregos, Seeligson, Tijerina - Canales - Blucher, and Stratton fields. The fields are in Jim Wells, Kleberg, and Nueces counties.

Completion of the plant, together with a large-diameter pipeline to the

PIPELINE

El Paso Natural Gas Co. has awarded contracts for more looping and supply lines in Oklahoma, New Mexico, and Arizona. R. H. Fulton & Co. has started building 47 miles of 10, 12, and 16-in. from Erick, Okla., to Shamrock, Tex., under supervision of Spread Superintendent Clint Schell. Fulton also has 15 miles of 30-in. in the vicinity of Jal, N. M.

Eastern Pipeline Contractors, Dallas, was successful bidder on 79 miles of 10-in. from Quartzsite to Yuma, Ariz., to be completed in December. John Griffith is superintendent. Engineers Limited Pipeline Co. received a contract for 102 miles of gathering lines in Aneth field, Utah.

Pasotex Pipe Line Co. has purchased a crude-oil gathering system in Scurry County, West Texas, from Gulf Refining Co. Pasotex, a subsidiary of Standard Oil Co. of Texas, will move the 5,000 bbl. daily from SACROC unit of Kelly-Snyder field and Sharon Ridge unit in Diamond M field through its main line to Wink and El Paso.

Cascade Natural Gas Corp. is constructing 17 miles of 8-in. gas line

upper Texas coast, will permit Humble to expand its gas deliveries to industrial customers. Current plans call for gas sales to be confined to markets in Texas.

Cost of the plant, along with the transmission system and an elaborate gathering system serving other adjoining counties, has been estimated at about $75,000,000. Part of the pipeline work is now under way.

Louisiana Allowable Climbs

LOUISIANA'S oil-production allowable in September is the highest it's been since May 1957.

Conservation Commissioner Ashton Mouton set the daily allowable at 838,407 bbl. This represents an increase of 28,735 bbl. a day over the August allowable and more than 70,000 bbl. daily over the allowable 2 months ago.

The current allowable is more than 150,000 bbl. short of the record high during the Suez crisis early in 1957. But it's the highest since the post-Suez allowable of 883,310 bbl. daily in May 1957.

Mouton raised the offshore allowable about 10,000 bbl. daily to a near-record 165,997 bbl. per day.

Refining Team Uses Radiation

RADIATION PROCESSING is coming closer.

More research will be required to determine which processes can use radiation in competition with conventional schemes. However, nuclear reactors can now be used to process petroleum and chemicals in commercial quantities.

A team of Esso Research & Engineering Co. engineers reported on their experience in radiation processing to the 1958 International Conference of Peaceful Uses of Atomic Energy at Geneva.

Dr. F. T. Barr, H. J. Ogorzaly, and T. A. Reiter said that cobalt-60 can be counted on to provide radiation in small-size processing units at commercially practical prices.

They said a specially designed nuclear reactor provides cheapest radiation but operates economically only in large capacities. Electron accelerators can do the job more cheaply than with cobalt in intermediate sizes. Each source can be used to take advantage of its special properties, however.

Nuclear reactors can be applied to radiation processing by passing the liquid process material directly through the core where the energy of atomic reaction is being released.

Petroleum, for instance, would surround the tubes containing the fissionable material and the coolants. Besides absorbing radiation and undergoing a chemical change, the liquid hydrocarbons will help to slow down the fission neutrons so as to keep the nuclear chain reaction going. Use of cobalt-60 or commercial accelerators would not result in any radioactivity in the products.

The Esso team said that radiation may be able to reduce the degree of pressure and temperature now required in process conversions. Also it might augment or replace catalysts, and it would improve quality.

Improved supplies of commercial quantities of radiation for chemical processing brightens the outlook for harnessing the field of atomic science and technology. The Esso engineers believe further research then will reveal where radiation processing can be economically utilized.

BRIEFS . . .

between Pasco and Attalia, Wash., under contract to Mid-Continent Contractors, Inc. Mid-Mountain also has a 9-mile, 4 and 6-in. line started last week for Washington Natural Gas Co. in Kings County, Washington.

Compressor equipment is being moved to the Hatton-Success natural-gas line of Saskatchewan Power Corp. in preparation for pressure testing the 90-mile, 14-in. line. The 125-mile, 10-in. SPC line from Regina to Steelman has been tested and is ready for operation.

Permian Basin Pipeline Co., subsidiary of Northern Natural Gas Co., plans to build 61 miles of 16-in. and 11 miles of field lines to take gas from Emperor field, Winkler County, Texas. The $3,681,600 project will provide an outlet for gas sold by Sun Oil Co., Phillips Petroleum Co., and Tidewater Oil Co. The construction awaits FPC approval. Tidewater already has an FPC sale certificate and the other producers have applications pending.

The Transportation Association of America has announced a program of annual awards, including a scholarship and grant to a college, to recognize achievements in the transportation field. The annual winner will receive a gold medal. There will be a $1,000 transportation scholarship for a student at the college or university of the winner's choice and $1,000 for the same institution to use as it chooses. The awards are sponsored by Seley Foundation, Inc., headed by Louis E. Seley, president of Republic Tank Car Co.

Lone Star Gas Co. crews will complete 8½ miles of 6-in. in Freestone County, 22 miles of 20-in. from Trinidad north, and 11½ miles of 12-in. replacement in Haskell County, Texas, this month. Twenty-five miles of 12-in. replacement also will be laid in Haskell and Taylor counties in September. A 880-hp. compressor station in Ambassador field will be finished in November.

The Pittsburgh Group Companies of Columbia Gas System, Inc., have laid 31 miles of gas line the first half of 1958 and plan 138 miles the last half of the year. Current projects include 7.5 miles of 8-in. in Indiana County, Pennsylvania; 5 miles of 12-in. from Empire to Toronto, Ohio; 17 miles of 20-in. from York to Abbottstown, Pa.; 5.6 miles of 26-in. from Hickory to Robinson Township, Pennsylvania; and 15.6 miles of 20-in. from Waynesburg to Green Township, Pennsylvania. Contractors are Felmont Oil Corp., Otis Eastern Service, Inc., and A. J. Curtis & Co.

Also for Pipeliners . . .

IN THE NEWS: Laurel products line hurdles one major obstacle: Delaware River crossing (p. 102) . . . Louisiana governor threatens even higher gas tax if companies protest recent increase (p. 107).

A complete list of pipeline projects is published the last issue of each month. New jobs and contracts are reported each week in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Pipelines find favor in transporting ethylene (p. 150) . . . Microwave system for Four Corners (p. 166) . . . Great Lakes employes learn about fire fighting (p. 183).

PUSHING a button starts oil flow from shore to ship as . . .

Speedy Terminal Loads Tanker

GULF REFINING Co. claims to have the fastest oil-loading terminal in the United States at its recently-expanded barge and tanker facilities on the Mississippi River below New Orleans.

The company announced completion and full operation of a dock for loading supertankers at the Ostrica, La., terminal. The new installation was added to existing facilities for handling T-2 tankers and barges.

The new facilities are designed to load supertankers at a maximum rate of 38,000 bbl. per hour.

As a result of the expansion, the terminal now can load several barges, a T-2 tanker, and a supertanker simultaneously. The docks can handle more than 80,000 bbl. of crude oil per hour when one vessel of each type is being loaded.

The terminal is believed to have established a new U. S. record by loading a supertanker of 32,500 dw. tons in approximately 6½ hours. The 604-ft. vessel carries enough crude oil to supply the parent company's 282,000-bbl. refinery at Port Arthur, Tex. almost a full day.

The crude is carried to the terminal by 26-in. pipelines and to the vessels through 20-in. lines. Flexible loading hoses then pipe the crude into the holds of the tankers.

Crude from 11 fields in the offshore and delta areas is handled by the Ostrica terminal, which is about 75 miles south of New Orleans. The installation has storage for 750,000 bbl.

Pump stations and pipelines serving the loading facilities are connected by teletype, radio, and lease telephones.

Most of the crude leaving the terminal goes to Gulf's Port Arthur and Philadelphia refineries. A smaller volume is handled on a contract basis for other companies.

INDUSTRY BRIEFS . . .

Sunset International Petroleum Corp. has acquired additional production in the Raisin City, Helm-Lanare, and Maricopa fields of California totaling 400 net bbl. of crude oil daily, with reserves of 800,000 net bbl. The $850,000-purchase was made from American Eagle Corp. It added 16.7 net wells and 377.8 net producing acres to Sunset International's holdings in the area. It increased the company's net daily oil production in the area from 464 bbl. to 856 bbl.

W. B. Cleary, Inc., of Oklahoma City, has purchased the stock of Montin-Benson Corp. for an undisclosed price. The purchase included interests in 22 wells in Kansas, 14 in Oklahoma, 3 in New Mexico, and undeveloped acreage. Montin-Benson will be operated as a wholly owned subsidiary of W. B. Cleary, Inc.

Cuban American Oil Co., Dallas, has acquired all assets of Owanah Oil & Development Corp., Denver, for 245,000 shares of treasury stock in Cuban and cash totaling more than $50,000. The Cuban stock is worth approximately $735,000.

Owanah assets included 100,000 acres of leases and 47,000 net acres of overriding oil royalties located in three basins in Alaska, plus 44,000 net overriding royalty acres scattered throughout eastern Utah and the Paradox basin of Utah and western Colorado.

Northern Mud Co., Billings, Mont., has purchased a portion of the assets of Service Mud Co., Sterling, Colo. Service Mud sold its assets in the Four Corners area but will retain those in eastern Colorado and Nebraska. Sam Bedingfield, president of Service Mud, will serve as advisor to Northern Mud for at least 1 year.

Pacific Petroleums, Ltd., has offered to take over Humber Oils, Ltd., on the basis of one share of Pacific for nine of Humber. Humber has oil well and acreage interests in Pembina, Keystone, and other Alberta areas, acreage in Manitoba and Saskatchewan, and a share in exploration rights on the Great Barrier Reef of northeastern Australia. Announcement of the offer was made by the presidents of both companies.

The American Association of Oilwell Drilling Contractors is now taking orders for the fourth edition of its "Tool Pushers Manual." The revised and expanded manual can be obtained from the AADC headquarters office in Dallas.

Headquarters of Midstates Oil Corp. will be moved from Tulsa to Houston by the company's new owner, Tennessee Gas Transmission Co. Midstates employs about 65 persons in Tulsa. Transfers to Houston and field offices will take place between now and October 1. TGT recently acquired the stock of Middle States Petroleum Corp., parent company of Midstates.

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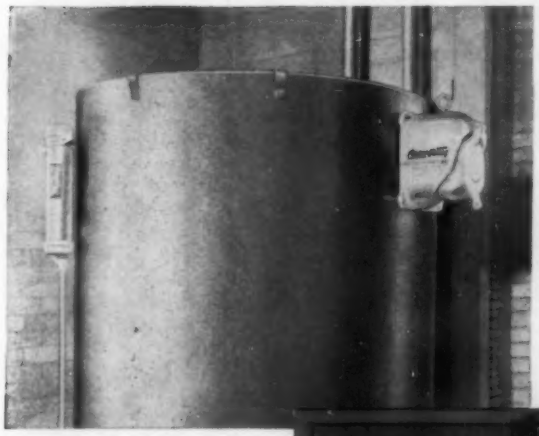
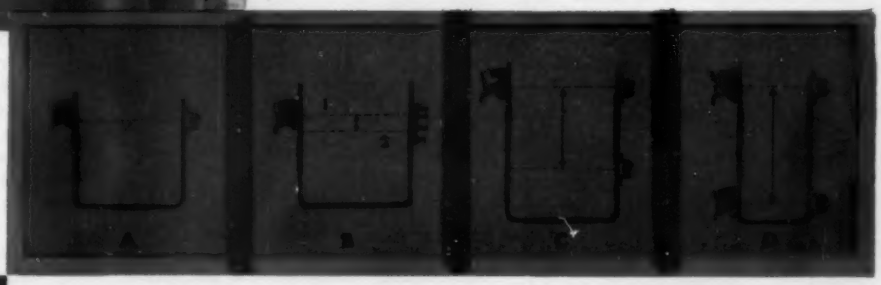


Adaptable to four methods of operation, AccuRay's Detector-Controller offers outstanding advantages over float-level type control systems. It is easily installed and maintained and is priced from only $465.00. The Detector-Controller utilizes two units—a radiation source housing, which provides more than adequate shielding, and a detector. Both units are mounted externally . . . thus are free from fouling by process materials. Accuracies can be maintained to ± ⅛" as a high or low level alarm. The source housing can be pivoted to provide radiation shielding during work inside the tank. Design of the instrument is in accordance with accepted standards for both explosion-proof and weatherproof operations.



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A High or Low Level Control . . . The detector is mounted diametrically opposite the radiation source. When the material moves above the level of the detector, the radiation is cut off, causing the output relay to change position. When the material drops below the level, the output relay is thrown to its opposite position. **B** Narrow Band Control . . . The detector is mounted vertically along the tank, resulting in narrow band control. When the material moves above position (1), a signal is provided from the output relay. The opposite signal is provided when the material drops below level (2). **C** Wide Band Control . . . A single source unit is teamed with two detector elements. The material can be controlled within the distance separating the high and low level detectors. The signal can also be used to provide a combination high-low level alarm system. **D** Extra-Wide Band Control . . . Two source units are teamed with two detectors in cases where the vertical separation desired is large relative to the tank diameter. This system can also provide a high or low level alarm.

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Oil Search Is Picking Up in Philippines

• Most work is centered on Luzon where Stanvac rig is probing. But other firms are busy evaluating promising blocks elsewhere. Geologists compare thick sediments with Far East's rich producing areas.

ONLY one heavy rig is churning in the Philippines right now, but without fanfare a large-scale exploration program is quietly gathering a head of steam.

The islands have been touted as a top prospective area for so long geological reports have grown long grey hair. But new data is gradually being added which makes exploration possibilities as hopeful as ever.

Most of the basin areas already are under concession. Standard-Vacuum Oil Co. and Caltex are the major companies with acreage. Independents with some degree of local interest hold the rest.

Stanvac is down to 7,260 ft. in Ipil 1, its second wildcat in the Cagayan Valley. It is testing small gas shows around 4,300 to 4,400 ft. Caltex has surface parties at work on nearby acreage. It may drill its first test next year.

The smaller companies include Philippine Oil Development Co. (PODCO), San Jose Petroleum, Inc., Acoje Mining Co., Republic Resources & Development Corp. (REDECO), White Eagle Overseas Co., Inc., American Asiatic Oil Corp., and Philex Mining Co. They have hired consultants, put surface parties in the field, and are doing some shallow drilling.

Here is why some geologists think prospects are tops:

... **The Philippines are** the only major group in the 6,000-mile archipelago stretching from Siberia to Burma without at least some commercial production.

... **Thick marine sediments** have been correlated definitely with similar deposits in Borneo, Java, and Sumatra.

... **Gas or oil shows** were found in three dry holes drilled in the last 2½ years in the Cagayan Valley. The main reservoir objective was not reached, and the tests were not diagnostic.

The sediments are Tertiary. Deposits laid down in this period produce much of the oil in Indonesia. There are several other striking similarities

between the Philippines and Far Eastern production.

Most oil in the Far East comes from long, narrow geosynclinal basins from 180 to 550 miles long, and from 30 to 135 miles wide. The major basins in the Philippines are similarly shaped, although they are much smaller.

Producing basins in that part of the world generally have sedimentary sequences ranging from 16,000 to 31,000 ft. thick. Philippine basins appear to be 9,000 to 30,000 ft. thick.

Source rocks in many productive parts of the Far East are believed to be a shale containing abundant organic material. This type of shale has been found in nearly all Philippine basins.

Crude production in the Far East comes chiefly from reservoir rock consisting of more or less shaly sandstone. Sandstones crop out abundantly in Philippine basins. There may be a hitch because the Philippine sandstones are frequently feldspathic. But some geologists believe there is sufficient porosity and permeability in these rocks to act as reservoirs.

Another point in the Philippines' favor is that quartz-bearing sandstones found in different parts of the islands appear to have excellent reservoir characteristics. There also are vuggy, reef-type limestones that could possibly act as reservoirs.

Virtually all Far East production is from anticlines. Numerous structures of this type have been indicated in the Philippines by survey work.

Cagayan Valley . . . Most work right now is going on in the Cagayan basin, a flat to hilly valley in northeastern Luzon. It is 30 to 35 miles wide and runs northward 120 miles before opening to the sea.

Some parts of the valley looked so good that Stanvac, Caltex, and PODCO jumped for the same acreage. Stanvac and Caltex each has some of its acreage under cross-option with PODCO.

The three dry holes drilled in the valley are now known to be on the thickest part of the basin, with a section of at least 20,000 ft., and maybe 30,000 ft. The principal reservoir objective was never reached.

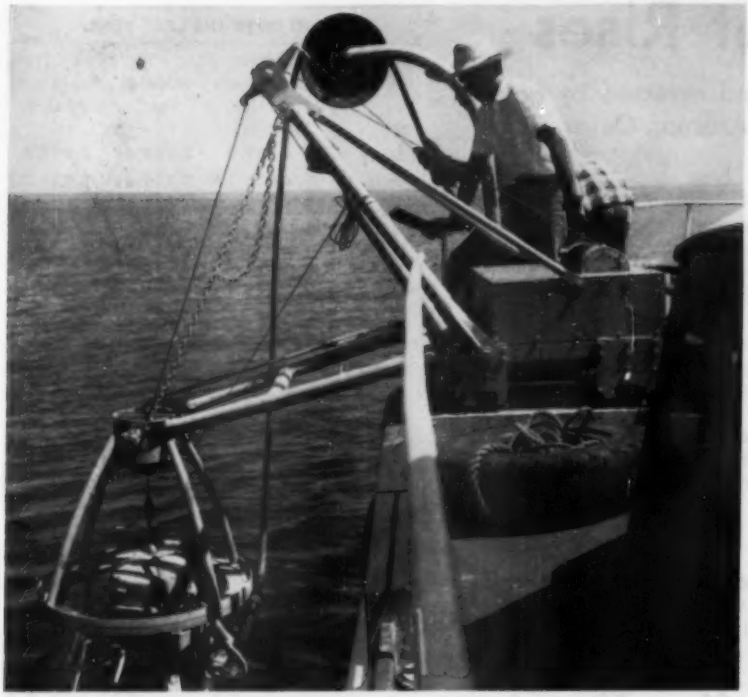
PODCO got the show started with Tumauini 1, drilled on the large Tumauini anticline. The well was lost at 10,400 ft. because of caving hole. Tumauini 2, located 3/5 mile north, was abandoned at 13,512 ft. because of cave-ins and high costs.

The Tumauini wells drilled through a continuous siltstone section of over 10,000 ft. Sandstone laminae in the siltstone yielded low volume, but very high pressure gas, requiring the use of 120 lb. per cubic foot mud.

Stanvac drilled Faire 1 on Faire anticline. It abandoned the well at 10,324 ft. when steeply dipping beds were encountered.

The company's present Ipil test is in the south end of the basin, where there is a chance that a basal sandstone section is within range of the N-55 rig. The well is located on a seismic structure which has no surface expression.

Central Valley . . . San Jose, PODCO, and REDECO have rights blanketing



LIVELY INTEREST in the Philippines includes Luzon's Manila Bay. Diving bell with gravity equipment is being lowered in water to study acreage held by San Jose Petroleum, Inc., a subsidiary of Pancoastal Petroleum Corp. Century Geophysical Corp., Tulsa, is doing the work.

most of the Central Valley basin.

The 125-by-40-mile basin is the most accessible in the Philippines, running from Manila Bay on the south to Lingayen Gulf on the north.

Compared with the Cagayan Valley, the Central basin has a greater number of indicated potential reservoirs, and it does not have the thick caving siltstones that troubled PODCO in its Tumauini tests.

PODCO drilled two dry holes to about 4,250 ft. in the southern part of the basin several years ago. Extensive geological, magnetometer, and gravity work since then, mostly by San Jose, has turned up several northwest-southeast trending anticlines in the northern part of the basin.

Several anomalies turned up in surveys of the southern part of the basin.

Other prospects . . . Work also is under way on most remaining prospective areas, including Cotabato basin and Agusan-Davao trough on Mindanao Island, and Iloilo basin of Panay.

Undefined basins, mostly offshore, cover much area in the smaller islands. The southern part of Mindoro has an attractive folded section. The fringe of Cebu Island on three sides has several thousand feet of marine sediments.

Shallow drilling was done on Cebu more than 60 years ago. One barrel per day of 30°-gravity crude is still bailed from a 500-ft. hole drilled in the early 1900's. Acoje Oil drilled a 5,810-ft. well, Libertad 1, on Bogo anticline in northern Cebu this year. A number of noncommercial shows were reported in at least one of a number of strat tests being drilled in the same area.

Other possible areas are Leyte, Bohol, and Bondoc Peninsula of southern Luzon. Some hand dug wells in southern Luzon more than 300 ft. deep produced up to 2 bbl. daily nearly 40 years ago. Richmond Petroleum Co. drilled four wells in the area in the 1920's. All had caving trouble, with small shows in the three deepest wells.

Exploration play seems headed for a continuing pickup. PODCO may start a 5,000 to 10,000-ft. well this year on Leyte or Panay. Acoje will drill another test on Bojo anticline if evaluation of present data warrants it. Receco is planning a deep well on Mindoro.

San Jose, a subsidiary of Pancoastal Petroleum Corp., is well into an 18-month gravity program. This will be followed by a 12-month seismic program, after which a location will be selected on the company's 2 million acres.

Caltex has two geological parties and one seismic crew in the field, surveying for next year's expected deep test in the Cagayan Valley. The Caltex acreage is held through Texaco Overseas Oil Co. and California Asiatic Co. This company is separate from American Asiatic, which is a local firm backed by Philippine capital.

Aussies Find Gas

shows at Fitzroy wildcat in western part of the country.

THE LONG and costly exploration play in Western Australia has had a small sign of encouragement.

West Australian Petroleum, Pty., (WAPET) has encountered two gas shows in Meda 1 in the Fitzroy basin. Gas flowed at the rate of 100,000 cu. ft. daily on a drill-stem test from 6,682 ft. to 6,692 ft. Further down hole, traces were found at 6,876 to 6,883 ft. in a section of vuggy, sugary limestone.

WAPET has had little encouragement so far since it shifted its main efforts to the Fitzroy basin from the southwestern coast. Caltex is 80% owner. Ampol, a local company, holds the rest.

Government helps . . . WAPET is one of the five companies splitting a $1.1-million subsidy put up by the government to encourage exploration.

Others include Santos, Ltd., which will drill a 14,000-ft. test at Cordillo Downs jointly with a subsidiary of Delhi-Taylor Oil Corp. (OGJ, July 21, p. 68).

Humber Barrier Reef Oils will drill on an atoll off Queensland. Broken Hill will drill in the vicinity of Portland, Victoria. Australian Oil & Gas Corp. is looking for gas in the Penrith area of the Sydney basin.

Kuwait Capacity Is Increased

CRUDE-PRODUCING capacity in Kuwait has risen another notch with the opening of two new gathering centers in Burgan field.

Each of the stations can handle 180,000 bbl. daily, taking crude from about 20 wells. The gathering centers are officially known as No. 12, on the southeastern end, and No. 13, on the southwestern end of the field.

Burgan has 211 wells served by 11 gathering stations. Magwa - Ahmadi field to the north has 76, served by the two other stations. Operator, Kuwait Oil Co. is owned by British Petroleum Co., Ltd., and Gulf Oil Corp.

World Output Rises

. . . in June. Downward trend reversed by gains in all major areas. Saudi Arabia, Qatar drop.

FREE-WORLD crude production in June ended its downward sweep with an over-all gain of 300,000 bbl. daily.

The United States, Canada, and Venezuela all made some gains. The Middle East production was also ahead of the preceding month. Declines in Saudi Arabia and Qatar were more than offset by increases in Kuwait, Iran, and in Iraq, where output neared the best months in the days before the Suez crises.

Angola is now among the world's countries with commercial production. Output of about 4,000 bbl. daily in the Portuguese territory on the west coast of Africa comes from two fields, Luanda and Benfica.

The concession holder is Cia. Concessionaria de Petroleos de Angola (COPA), a joint company set up by the government and Petrofina after Petrofina had discovered commercial oil. The government holds 33⅓% interest, Petrofina 33⅓%, its local subsidiaries 11⅓%, and other groups and the public the rest. Petrofina is the operator.

TREND OVER THE LAST YEAR

	Western Hemisphere less U. S.	Middle East	Total, Free World outside U. S.
1957			
June	4,159.9	3,964.6	8,892.4
July	4,076.2	3,989.4	8,824.7
Aug.	3,924.5	3,955.0	8,649.6
Sept.	3,759.6	3,969.5	8,504.6
Oct.	3,758.8	3,878.9	8,435.5
Nov.	3,654.7	3,704.2	8,142.9
Dec.	3,661.7	3,973.6	8,412.4
1958			
Jan.	3,680.4	4,034.0	8,465.6
Feb.	3,798.7	4,057.6	8,662.1
Mar.	3,672.6	4,243.0	8,631.3
Apr.	3,613.5	4,109.2	8,528.0
May	3,584.9	4,087.8	8,470.2
June	3,677.3	4,156.8	8,663.3

World-Wide Crude Production:

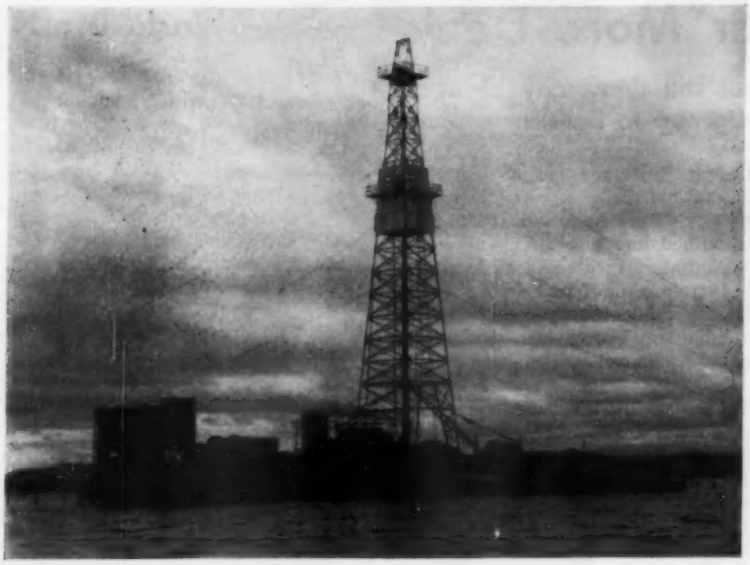
Daily Average in Thousands of Barrels

Country—	June 1958	May 1958	June 1957
Western Hemisphere			
Argentina	93.3	93.3	95.5
Bolivia	9.5	9.5	9.5
Brazil	52.3	43.5	23.7
Canada	420.0	405.0	528.3
Chile	14.9	14.9	11.7
Colombia	121.9	121.9	127.9
Cuba	1.0	0.9	1.0
Ecuador	8.6	8.6	8.8
Mexico	255.0	255.0	236.7
Peru	53.1	53.1	52.8
Trinidad	101.9	101.0	95.4
Venezuela	2,545.8	2,478.2	2,968.6
Total	3,677.3	3,584.9	4,159.9
Europe			
Austria	52.5	52.7	60.6
France	27.2	27.3	28.6
West Germany	87.9	85.6	78.8
Italy	27.5	27.7	31.1
Netherlands	29.2	28.8	29.4
Turkey	5.4	5.4	5.6
United Kingdom	1.7	1.7	1.6
Yugoslavia	9.2	8.9	7.6
Total	240.6	238.1	243.3
Middle East			
Bahrain	40.4	40.2	30.1
Iran*	794.0	749.0	736.0
Iraq†	755.7	707.9	439.5
Israel	1.2	1.2	1.2
Kuwait	1,383.2	1,367.3	1,380.6
Neutral Zone	70.0	70.0	67.1
Qatar	161.0	172.7	145.8
Saudi Arabia	951.3	979.5	1,164.3
Total	4,156.8	4,087.8	3,964.6

Country—	June 1958	May 1958	June 1957
Other Asia			
British Borneo	119.0	119.0	119.9
Burma	9.2	9.2	9.7
India	8.5	8.5	8.8
Indonesia	340.0	320.0	313.5
Japan	6.8	6.8	6.1
New Guinea	3.7	3.0	6.3
Pakistan	5.9	5.9	5.8
Total	493.1	472.4	470.1
Africa			
Algeria	10.4	10.4	0.3
Angola	4.0	4.0	....
Egypt	64.7	56.2	49.0
Gabon	8.3	8.3	3.7
Morocco	1.5	1.5	1.5
Nigeria‡	6.6	6.6	....
Total	95.5	87.0	54.5
Free World			
Foreign	8,663.3	8,470.2	8,892.4
United States	6,341.0	6,233.0	7,107.0
Total	15,004.3	14,703.2	15,999.4
Communist Countries in Soviet Orbit			
Romania	223.0	223.0	220.0
Russia	2,180.0	2,180.0	1,930.0
Others	60.0	60.0	50.0
Total	2,463.0	2,463.0	2,200.0
WORLD TOTAL	17,467.3	17,166.2	18,199.4

*Includes estimated 5,000 bbl. daily from Naft-i-Shah field not operated by consortium companies. †Includes estimated 3,600 bbl. daily from Naft Khaneh field, operated by British Petroleum Co. ‡Test production.

Figures are from reliable industry reports or government sources. Data for Communist countries in Soviet orbit, which includes the European satellites and Red China, are based on competent estimates. Authentic information is not available on month-to-month production in these areas. Estimates were made where complete reports are lacking.



Japan Drills First Marine Test in Lake

JAPAN has an ambitious offshore drilling program planned for subsea structures off her western coasts, but the country's first marine drilling operation is under way in 3 ft. of water in an inland lake.

Kotohama No. 1 was drilling 1¼ miles from the shore of Lake Hachirogata on the Oga Peninsula, 12 miles northwest of Akita City in northern Honshu. The well, projected to about 5,000 ft., will test a sharply defined anticline revealed by seismic work.

The lake well was started after Japan Petroleum Exploration Co., a joint government - private company, discovered a new field at Sarukawa, 4 miles to the west. After drilling one dry hole in the area, the Japanese found a 23-ft. section of Miocene pay in Sarukawa Nr. 2 at 3,277 ft. The well was drilled to 4,920 ft. and then plugged back to the pay for testing.

In a series of 10-hour tests, the well flowed 32 bbl. of 33°-gravity crude through a 12/36-in. choke. The well was shut in and the crew moved to the marine operation.

Oil Target of Algerian Attacks

OIL facilities in France were the main target of Algerian terrorism last week.

Tank farms and refineries throughout the country were attacked by saboteurs in a carefully timed and coordinated campaign of terror in the early morning hours. Most of the damage was sustained by oil storage areas, with at least 21 tanks in three areas destroyed.

A sea terminal at Mourepiane near Marseille was hit the hardest. The area is a common terminal used by several major companies. French authorities said 18 firemen were injured when a blast rocked the tank farm 16 hours after it was set afire. The blaze was still out of control a day later.

Retaliation suspected . . . The wave of attacks marked the first time Algerian nationalists carried their struggle from Africa into France itself, except for fighting among themselves.

Concentration on oil facilities may have been in retaliation for French development of crude supplies in Algeria. Marseille is destined to become a major import area for Algerian crude. It already is taking the comparatively small output from Hassi Messaoud.

The 85,000-bbl. Esso Standard plant at Port Jerome sustained negligible damage. An Algerian was killed when a bomb exploded as he placed it underneath a pipe leading to a storage tank. A small fire started by the blast was quickly put out.

A bomb was planted at Socony Mobil's 17,000-bbl. refinery at Gravenchon, but was discovered and killed. Two 7,900-bbl. gasoline tanks at Socony's Toulouse storage area were dynamited. About 5,000 bbl. of products were destroyed. There were no injuries.

Indians on Warpath

in Paraguay. One is injured in raid on Pure operation.

MARAUDING Moro Indians added a taste of the Old West to Pure Oil Co. operations in Paraguay when they raided an outlying construction party in the Chaco jungle.

A road-building crew drove off a party of about 40 scantily clad braves who swooped down with spears, bows, and arrows. Shots fired in the air dispersed the attackers.

One crew member reportedly was wounded, hit by a spear while taking a lunch-hour nap in a tent. One apparently injured Indian was pulled back into the jungle by his fellow braves.

Southeast of the Indian raid, and 345 miles northwest of Asuncion, Pure Oil is drilling ahead at 4,500 ft. at its first wildcat, Fortin Madre Jones. Pure is operator in a 23,200-sq.-mile concession in which it has a 30% interest.

Partners are Tidewater Oil Co., Sinclair Oil Corp., Gulf Oil Corp., and Williams Bros. Co. of Tulsa, which is handling road and airport construction (OGJ, July 14, p. 87). Williams Bros. has cut a 260-mile road from Puerto Casado north into Pure's concession and has opened nine airports.

Indians were visitors twice earlier this summer. They first broke into a warehouse where they tried out marshmallows and maple syrup and made off with machetes and axes. A group of them later paid a social call at a road-building site, laying down their primitive arms and offering beads and feathers as a sign of peaceful intentions.

Japanese Set Drilling Goal

THE JAPANESE company which holds the Neutral Zone offshore concession is planning to drill three to five wells per year.

Arabian Oil Co. expects to start the $5-million-plus program next year. It will pay up to 60% of the cost in dollars for a drilling unit, a towing barge, and labor. Japanese firms will furnish drilling supplies.

The company is about to decide on a drilling contractor for the project. Offers from U. S., Dutch, and Italian firms are under study. A mobile outfit will be used. A 3-month seismic survey is already under way in the area, with Geophysical Service International doing the work.

Brazil Dickers for More Deals

. . . involving equipment, but still shuns any big-scale exploration contracts. British group to build new plant.

WHILE Brazil has yet to sign big-scale contracts with foreign companies for exploration and production work, its oil agency, Petrobras, is an old hand at tying down financial deals that are by no means chicken feed.

The government last week was pondering the pros and cons of following in the footsteps of Argentina, which is signing up more than $1 billion worth of development work on a contract basis.

At the same time, Petrobras without a fuss was arranging for British-made equipment for the new 90,000-bbl. Caxias refinery near Rio de Janeiro.

There is no conflict between Petrobras' initiative in seeking foreign help for equipment and its shyness in regard to contracts for exploration and development work. The question of foreign participation in oil-field development was always a political hot potato.

But from the beginning, Petrobras has been able to seek foreign financing. The government guarantees up to 25% of the loans.

Despite the shaky Brazilian economy, Petrobras has two strong points in across-the-table negotiations for credit. It is a big buyer of crude with plenty of rival sellers to choose from. It also buys equipment from among highly competitive manufacturers. This year alone it will buy $70 million worth.

Caxias refinery . . . In its latest deal, Petrobras promised to buy at least $11 million worth of refinery equipment from a British group known as British Refinery Constructors (Brefcon), which will build the plant.

Foster Wheeler Co. has contract for design, engineering, and supervision of construction. Petrobras' next step in the project will be toward a 60,000-bbl. daily supply contract for the plant. Petrobras reportedly plans to build a 24-in., 80-mile pipeline to tie in with the proposed new refinery.

Reports from Rio de Janeiro indicate Petrobras hinted to potential suppliers of the new refinery it would be better disposed toward companies that came through with financial aid to help build it. Standard Oil Co. of California lent Petrobras $5 million, and The Texas Co., $6 million.

Royal Dutch-Shell and Esso Export Corp. did not make any loans to Petrobras. But they are buying about 25,000 bbl. daily of waxy, high-quality crude from Bahia fields. The crude is refined into lubricating oils in the West Indies, then reexported.

Petrobras, in turn, imports lower-quality crude for its own refineries, winding up with a profit of several cents per barrel.

Other deals . . . The agency has tied down numerous other deals.

French groups are providing $15 million worth of equipment for expansion of Mataripe refinery and are financing $7 million worth of material for a fertilizer plant. California Standard lent $1 million for an asphalt plant.

Refinery equipment made in Europe costs about 30% less than in the United States, with slower delivery time. European firms also require a lower down payment than most U. S. companies. They generally charge 10% down, 10% on delivery, with the balance payable over 5 years or more.

Refinery Planned

for Jamaica. Capacity will be 16,500 bbl. per day.

A NEWLY formed company plans to open Jamaica's first refinery in June 1960.

Jamaica Oil & Chemical Co., Ltd., will build a plant with initial capacity of 16,500-bbl. plant near Kingston. Universal Oil Products is handling preliminary design for the $15-million project. Construction contracts are due to be awarded soon.

The refinery will make Jamaica self-sufficient for all products except lubricating oils. Jamaica Oil's timetable calls for an output of between 16,000 bbl. and 17,500 bbl. daily in 1961, the first full year of operation.

Full capacity of the refinery will be 25,000 bbl. daily. The company is studying the possibility of exports to sterling markets. Jamaican demand last year averaged 12,500 bbl. daily.

Frank D. St. Hilaire is president of Jamaica Oil, and John W. Kaiser, Jr., vice president. Colorado Oil & Gas Corp. has a substantial interest. The government is granting a 7-to-10-year tax-free inducement to the refining company, after which excise taxes will be paid.

———*World* briefs

A 13,000-ft. wildcat is scheduled to get under way early this month east of Abidjan in West Africa's Ivory Coast. The well is being drilled by Ste. Africaine des Petroles, Plymouth Oil Co., Benedum-Trees Oil Co., and M. L. Benedum on a 2,400,000-acre concession (OGJ, Aug. 11, p. 87). The rig is owned by Laughlin-Porter Drilling Co., Midland, Tex.

Siboney - Carribean Petroleum Co. will begin deepening its Cacique 1G near the south coast of Cuba's Camaguey Province early this month. The test was halted in 1956 at about 7,000 ft. when rig capacity was reached. The wildcat had encouraging shows of gas. The Cuban Government has agreed to lend 40% of the cost of deepening the well. Repayment would be solely out of production.

Argentina will take a look at the Russian offer of $100-million worth of oil equipment in a barter deal for wool, hides, and other Argentine raw materials. Deputy Jose V. Liceaga is heading an economic mission to Moscow to discuss the offer.

Another discovery has been made in Nigeria by Shell-BP Development Co. A well at Obigbo,, 10 miles northeast of Port Harcourt, is undergoing production tests. Total depth is 11,446 ft. The rig has been moved to a new location 10 miles east of Port Harcourt at Ebubu.

Groundwork for a petrochemical industry in Algeria has been laid with the formation of Cie. Algerienne de Petrochimie by four French chemical companies and two banks. Participants are putting up $47 million.

Caltex may seek permission to build a refinery near Durban, South Africa. The local Durban government has turned down a similar request by Royal Dutch-Shell for approval of a site on reclaimed land in Durban Bay. It feared air pollution. But it has offered to help Shell find an alternate site.

An Israeli wildcat has been started 20 miles southeast of Tel Aviv by two U. S.-financed companies, Pan-Israel Oil Co., Inc., and Israel-Mediterranean Petroleum, Inc. The well's objective is the sands which are productive at Heletz field to the south. It was located on a 98,000-acre block after 10 months of seismic work by an American crew. Projected depth is 8,000 ft.

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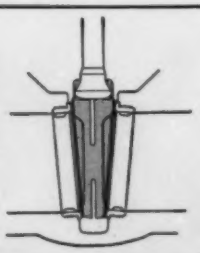

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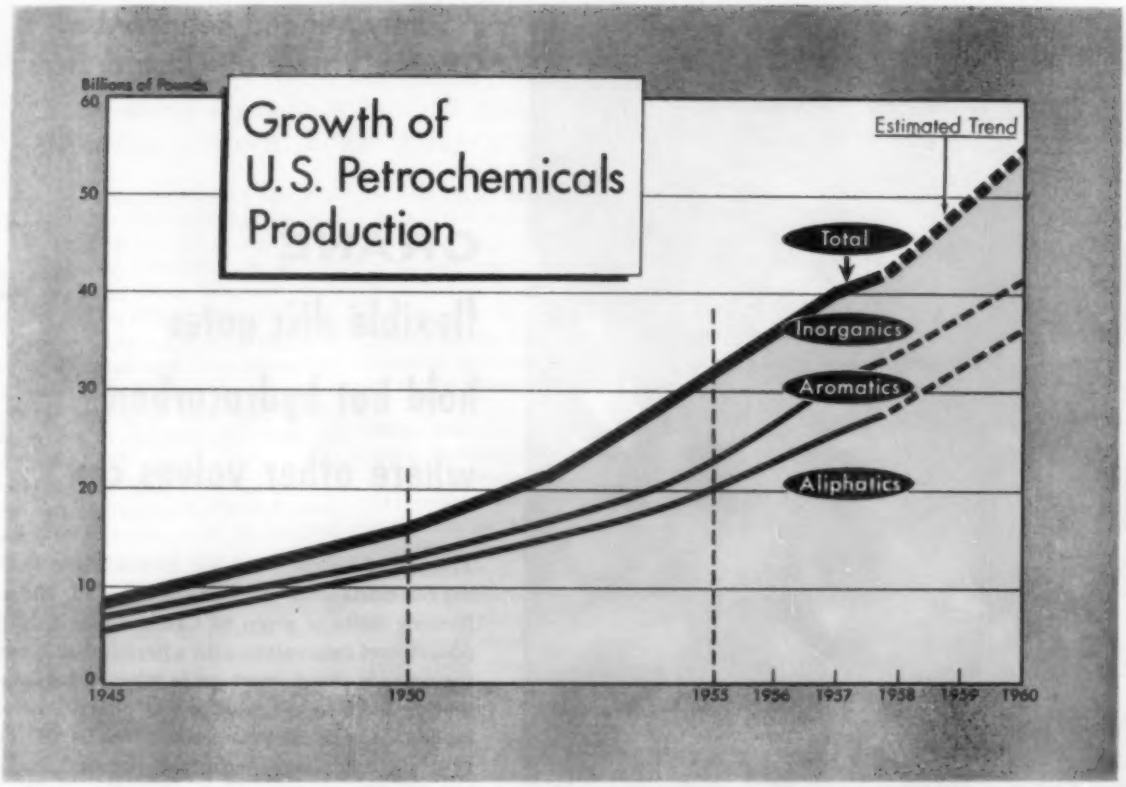


U. S. PETROCHEMICALS PRODUCTION, 5-YEAR GROWTH RATES—Surplus capacity is a new experience, but additional investment will be required to commercialize new research and development discoveries. The aliphatic petrochemicals should continue to grow 10-12% per year through 1965. Growth of inorganics is not likely to be above 4.4% in the early 1960's. Aromatic petrochemicals growth will drop to 9.9% per year in the 1960's.

Petrochemicals on the move

The petrochemical industry, like many others, has not been immune to the general business recession of 1957-58—but petrochemicals have fared better than most other industries. Both tonnage and value of output for 1958 will show increases over 1957 of 5-6%. Looking ahead to 1960, output of petrochemicals should be 25% greater than this year's production.

BY DR. R. L. BATEMAN
Director of Market Development
Union Carbide Chemicals Co.

PRELIMINARY ESTIMATES for 1958 indicate production of all petrochemicals will be 42.5 billion pounds —an increase of 5.5% over 1957 (Table 1). The corresponding figures of "all chemical" production show only a 2% increase. The petrochemical share of "all chemicals" is still increasing and will account for 28% of the total 1958 production. By 1960 production is expected to amount to 55 billion pounds and to represent 30% of "all chemical" production.

Petrochemicals Are Still Growing

The value of petrochemicals produced in 1958 shows an increase of 5.7% and is estimated to be $5.21 billion—the first year the value has exceeded $5 billion. By 1960 the value of petrochemical production should be close to $7 billion, representing 60% of the value of "all chemical" production.

These estimates point out that petrochemicals have performed better than the over-all chemical industry and the over-all economy. Nevertheless, there are changes, not readily apparent, that are occurring now, within the petrochemical industry. Assessment of these factors will become even more important in the future plans for profitable growth of those companies already in the industry or planning to enter.

Surplus capacity is the new experience, emphasizing these changes, which must be recognized. In 1958, the petrochemical industry operating rate is much lower

TABLE 1—U. S. PETROCHEMICALS PRODUCTION

	In billions of pounds				
	1956	1957	Per cent change 1956-57	Estimate 1958	Per cent change 1957-58
Petrochemicals:					
Aliphatics	24.2	25.9	5.8	27.6	6.6
Aromatics	3.5	3.7	5.7	3.9	5.4
Inorganics	10.0	10.7	7.0	11.0	2.8
All petrochemicals	37.7	40.3	7.0	42.5	5.5
All chemicals	145.0	149.0	2.7	152.0	2.0
Petros. as per cent of all chemicals	25.9	26.8	3.5	27.9	4.0

	In billions of dollars				
	1956	1957	Per cent change 1956-57	Estimate 1958	Per cent change 1957-58
Petrochemicals:					
Aliphatics	$3.63	$3.89	5.8	$4.14	6.4
Aromatics	0.60	0.63	5.0	0.66	4.8
Inorganics	0.38	0.41	7.8	0.41	...
All petrochemicals	$4.61	$4.93	7.0	$5.21	5.7
All chemicals	$8.43	$8.79	4.3	$9.19	4.6
Petros. as per cent of all chemicals	55.0	56.0	1.8	56.6	1.1

than has been the case in any prior year. Many large-tonnage petrochemicals including methanol, butadiene, ethylene oxide, styrene, vinyl chloride, and ammonia are running at only 65-85% of capacity. If an 80% operating rate today is assumed, the installed plant is capable of turning out in excess of 50 billion pounds. This would indicate that there should be no deficiency during the next 15 to 18 months. The oversupply has caused many companies to defer new plant expenditures and may be expected to retard the new investment rate until the 1960's.

Nevertheless, investment is required. To match the capacity of 55 billion or more pounds would require an expenditure of only $500 million in the next 18 months. The commercialization of new research and development discoveries alone will require the expenditure of this amount to give the industry a total of $6 billion in plant investment by the end of 1960.

Aliphatics—Steadiest Growth

A closer study of the three types of petrochemicals —aliphatics, aromatics, and inorganics reveals that aliphatic petrochemicals are still, by far, the largest group with the steadiest growth rate (Table 2). This year, production will total 27.6 billion pounds compared with 25.9 billions for 1957—an increase of 6.6%. This segment includes most of the largest-tonnage derivatives made from ethylene, propylene, and the butylenes, such as ethylene glycol, acetone and isopropanol, ethyl alcohol, butadiene, vinyl chloride, and polyethylene, to mention a few.

The olefins are extremely versatile raw materials

TABLE 2—PETROCHEMICALS—PRODUCTION AND GROWTH RATES

(Production in billions of pounds)

	Aliphatics	Aromatics	Inorganics	Total petrochemicals
1945	5.4	1.4	2.35	9.15
1950	11.8	0.95	3.4	16.1
1955	20.4	3.2	9.5	33.0
1958 prel.	27.6	3.9	11.0	42.5
1960 est.	36.3	5.0	13.7	55.0
1965 est.	60.0	8.0	17.0	85.0
Growth rate % per year:				
1945-1950	17.0	decrease	8.0	12.0
1950-1955	11.6	28.0	23.0	15.0
1955-1960	12.2	9.4	7.6	10.7
1960-1965	10.8	9.9	4.4	9.2

and a large proportion of the research expenditures of $300 million per year is directed towards the utilization of these basic starting materials. For the most part, selling prices of the aliphatic petrochemicals and the olefins have remained steady and, consequently, their value has grown with the tonnage expansion.

The aromatic family of petrochemicals is based predominantly on benzene, toluene, and xylene and, this year, will increase 200 million pounds to 3.9 billion—a gain of 5.4%. The average value is slightly lower, due principally to price decline of styrene, and total value of $660 million is 4.8% above the 1957 figure. The price weakness of the intermediates—benzene, toluene, and xylene—has been largely responsible for this trend.

The inorganic petrochemicals, ammonia, carbon black, and sulfur, at 11 billion pounds for 1958 will be 2.8% higher than last year. Due to the lower demands in 1958, prices have become soft. This is particularly true for "byproduct" sulfur which must compete with the world excess supply of Frasch sulfur. The dollar value of inorganic petrochemicals remains unchanged for both years at $410 million.

While it may appear at first glance that the petrochemical industry is slowing down, certain segments are still dynamic. Expansion in the next decade will be more selective and will depend to a greater degree on multistep chemical synthesis—utilizing the scientific advances discovered in the research laboratories of the industry.

Inorganic petrochemicals, based largely on natural gas for ammonia, and on petroleum for carbon black and sulfur will grow at a rate comparable to that of the over-all economy and not as great as the rest of the petrochemical industry. Tables 2 and 3 show that the annual growth rate was 23% in the 1950-55 period but is not likely to be above 4.4% in the early 1960's.

The expansion of aromatic petrochemicals also will be less vigorous during the next 10 years. The annual growth rate of 28% during the 1950-55 period will drop to 9.9% in the 1960's. The raw materials benzene, toluene, and xylene are more costly for synthesis—they are not as versatile building blocks as the aliphatic hydrocarbons and furthermore, competition

TABLE 3—INORGANICS (BY PRODUCT)
(Production in billions of pounds)

	NH_3	C	S	Total inorganics
1950	1.44	1.38	0.6	3.42
1955	5.3	1.75	2.4	9.45
1958 prel.	6.6	1.70	2.7	11.0
1960 est.	8.4	2.1	3.2	13.7
Growth rate % per year:				
1945-1950	5.4	5.6	25.0	8.0
1950-1955	29.0	5.0	32.0	23.0
1955-1960	9.6	3.8	6.0	7.6

TABLE 4—U. S. "OLEFIN" DEMAND
(In millions of pounds)

	1950	1955	1958	1960	1965
Ethylene (total)	1,500	3,000	4,200	4,800	6,500
"Chemical" ethylene*	1,400	2,500	3,400	3,800	5,200
Propylene (total)	900	1,400	1,900	2,000	2,800

	Growth rate % per year 1955-1960	1960-1965
Ethylene	9.9	6.2
Propylene	7.4	7.1

*Excludes polyethylene requirements.

from coal-produced aromatics will become more intensive.

The aliphatic petrochemicals should continue to grow 10-12% per year through 1965—not too different from the rate during the postwar period.

Ethylene and Propylene—Raw Material Changes

Since the aliphatics are based very largely on ethylene and propylene, the sources of raw materials for these olefins will be studied intently by the entire industry. The petroleum industry is interested in the greatest return for the byproducts from their refinery operations and more ethylene, propylene, and butylene will be recovered. With the upward trend of prices for natural gas and LPG resulting from expanding fuel demands, less dependence will have to be placed on these two raw materials for cracking stock for ethylene and propylene.

The chemical producers then will turn to the large supplies of unrefined natural gasoline and other heavy condensates which are now less suitable for the present day high-octane motor gasolines. Aliphatic petrochemicals based on propylene are expanding but the total propylene-based petrochemicals are still dwarfed by the ethylene-based petrochemicals. Table 4 shows total ethylene demand this year of the order of 4.2 billion pounds and propylene for chemical use about 1.9 billion. The growth rate over the next 7 years for both is estimated to be between 7 and 8% per year.

Petrochemicals are considered to be synthetic chemicals derived from petroleum or natural-gas hydrocarbons which, in many cases, are processed further by allied industries such as rubber, paint, textile, agricultural, detergent, and drug. Only that portion of the chemical operations which converts these natural raw materials to chemicals for the allied industries is included in the production and value estimates for the petrochemical industry.

A look at the most dynamic aliphatic petrochemicals substantiates the future sustained growth of ethylene and propylene chemicals. Polyethylene resin capacity is now about 900 million pounds per year and will continue to grow, but at a reduced rate, as new applications are established for the high and low-density types. Polypropylene is just getting started and its capacity of 30 million pounds per year will move upward slowly as the specific applications, for which it is best fitted, are found. The polyurethanes appear to be on the threshold of a rapid growth period. They will require large tonnages of low-cost aliphatics, such as polyesters and polyethers. The aromatic portion of the molecule is significant in value but comparatively low in its component weight in the resin.

The increasing demands for new fuels, lubricants, and fluids for automobile and aircraft engines will be supplied by the new products from the chemical-research laboratories. Many of these will be based on petrochemical raw materials. The organometallics, which include the "exotic" jet and rocket fuels, contain aliphatic raw materials attached to the metallic element.

The many synthetic fibers now finding acceptance with the consumer will replace or supplement the supply of natural fibers in the next decade and will require heavy tonnages of petrochemical intermediates.

By 1965, the demand for petrochemicals will grow to 85 billion pounds with a value in excess of $10 billion (Table 2). However, aliphatics based on ethylene, propylene, and butylenes will then represent 71% of the output compared with 65% today, reflecting the slower growth in inorganics and aromatics.

And now... The Journal's annual survey of petrochemical plants→

STARTING on the opposite page is the latest information available on petrochemical operations in the United States and Canada. This survey is compiled annually by the Journal's statistical department, and is the most complete of its kind published. It includes names of operators, plant locations, raw materials, and the principal products.

For convenience in using this information, the survey is broken down into six tables, five according to type of United States chemical product, and the sixth giving a rundown on Canadian operations. Table 1 is devoted to U. S. organics; Table 2 is a breakdown of nitrogen chemicals. The raw materials for rubber, butadiene, and copolymer are covered in Table 3. Sulfur and carbon-black information is outlined in Tables 4 and 5, respectively. Table 6 gives the Canadian picture.

These tables bear out Dr. Bateman's belief that the manufacture of petrochemicals has become a major item of business for many refining and chemical companies, and that the industry is still in a fast-expanding phase.

THE 1958 EDITION OF THE

JOURNAL'S SURVEY OF PETROCHEMICAL PLANTS

1. Organics 2. Nitrogen Chemicals 3. Butadiene and Copolymer 4. Sulfur Conversion 5. Carbon Black 6. Canada

THIS REPORT, presented in six parts for quick reference, is composed of plants using raw materials which are wholly or partially derived from petroleum or natural gas. The first five parts contain U. S. plants classified by type of operation. The sixth is a complete report of Canadian plants. Construction planned or under way is included.

1—ORGANICS, U. S.

A

ALLIED CHEMICAL CORP., Plastics and Coal Chemicals Div., Frankford, Pa.
Raw material: Propane-propylene blend.
Principal products: Phenol; acetone.

ALLIED CHEMICAL CORP., National Aniline Div., Buffalo, N. Y.
Raw material: Kerosine fraction; white oil fraction.
Principal products: Alky aryl sulfonates (water soluble); long-chain alkyl aryl sulfontes (oil soluble); dodecylbenzene.

AMERICAN CHEMICAL CORP. (Richfield Oil Corp., and Stauffer Chemical Co.), Southern California.
Construction: Plans to build plant to produce chlorinated hydrocarbons.

ALLIED CHEMICAL CORP., Nitrogen Div., Orange, Tex.
Raw material: Ethylene.
Principal products: Ethylene glycol; ethylene oxide; ethanolamines.

ALLIED CHEMICAL CORP., Semet-Solvay Div., Buffalo, N. Y.
Raw material: Ethylene (from residual oil fraction).
Principal products: Polyethylene resin pipe compound; high-melting-point polyethylene wax.

ALLIED CHEMICAL CORP., Solvay Products Div., Moundsville, W. Va.
Raw material: Methane (natural gas).
Principal products: Methyl chloride; methylene chloride; chloroform; carbon tetrachloride.

ALOX CORP., Niagara Falls, N. Y.
Raw material: Petroleum fractions.
Principal products: Oxygenated petroleum chemicals for rust preventives, lube-oil additives, mixtures of organic acids, and other oxygenated hydrocarbons.

AMERICAN CYANAMID CO., (Fortier plant), Avondale, La.
Raw material: Natural gas.
Principal products: Hydrocyanic acid; acrylonitrile; monomethyl styrene; acetylene (used internally).
Construction: Facilities for acrylonitrile derivatives are planned.

AMERICAN CYANAMID CO., Warners, N. J.
Raw material: Petroleum fractions.
Principal products: Oil-layer type of petroleum sulfonate (barium salt).

AMERICAN CYANAMID CO., Escambia Bay, Fla.
Construction: Will complete acrylic fiber facilities (27,000,000 lb. per year) late 1958.

AMERICAN OIL CO., El Dorado, Ark.
Raw material: Refinery streams.
Principal products: Propylene tetramer; polybutenes.

AMERICAN OIL CO., Destrehan, La.
Raw material: Refinery streams.
Principal products: Polybutenes.

AMOCO CHEMICALS CORP., Texas City, Tex.
Raw material: Petroleum fractions; refinery gases.
Principal products: Benzene-2° (1,000 bbl. per day); toluene; xylenes; hydrocarbon resins (petroleum polymer and condensation resins); aromatic solvents; drying oils; alkylated naphthalenes; nonene; methyl mercaptan.

AMOCO CHEMICALS CORP., Joilet, Ill.
Construction: Will complete October 1959, a 60,000,000 lb. aromatic oxidation plant to produce phthalic anhydride, isophthalic acid, terephthalic acid, dimethyl terephthalate, dimethyl isophthalate, and benzoic acid.

ATLANTIC REFINING CO., Philadelphia.
Raw material: Crude petroleum fractions; refinery gases; solvent extracts.
Principal products: Aromatic solvents; crude carbolates; crude cresylic acid; technical eicosane; nonene; crude mercaptans; alkylbenzene; dodecylbenzene sulfonic acid type of water-soluble alkyl aryl sulfonates.
Raw material: Asphalt.
Principal product: Thermoplastic resin.

ATLANTIC REFINING CO., Atreco, Tex.
Raw material: Petroleum fractions; refinery gases; solvent extracts.
Principal products: Detergent alkylate (from benzene and propylene tetramer); diisobutylene and triisobutylene.

ATLAS PROCESSING CO., Shreveport, La.
Raw material: Naphtha (400, F., e.p.) from natural gas extraction.
Principal product: Benzene (600 bbl. per day).

AURORA GASOLINE CO., Detroit, Mich.
Raw material: Naphtha fraction.
Principal product: Mixed aromatics (3,850 bbl. per day).

B

BARIUM REDUCTION CORP., South Charleston, W. Va.
Raw material: Natural gas.
Principal products: Carbon disulfide; hydrogen sulfide.

C

CALCASIEU CHEMICAL CORP. (Cities Service Co., Continental Oil Co., Mineral Industries, Inc., Sears, Roebuck & Co.), operated by Petroleum Chemicals, Inc., Lake Charles, La.
Raw material: Ethylene oxide.
Principal products: Ethylene glycol (8,000,000 gal. per year); glycol sludge (775,000 gal. per year).

CALIFORNIA - SPRAY CHEMICAL CORP. (subsidiary of California Chemical Co.), Richmond, Calif.
Raw material: Petroleum bases.
Principal products: Summer and winter oil sprays; aromatic solvents; spray detergents; emulsifiers.

CALLERY CHEMICAL CO., Muskogee, Okla.
Construction: Building units to produce and purify hydrogen, nitrogen, and carbon dioxide. Estimated cost is $3,400,000.

CELANESE CORP. OF AMERICA, Bishop, Tex.
Raw material: Natural gas; liquefied petroleum gases (propane, butanes).
Principal products: Propylene oxide; propylene glycol; dipropylene glycol; 1,3-butylene glycol; 2,3-butylene glycol; acetone; methanol; formaldehyde; formaldehyde solutions in alcohols; paraformaldehyde; trioxane; acetaldehyde; acetic acid; n-propanol; isobutane; n-butyl alcohol; special solvents; n-propyl acetate; pentaerythritol; 3-methoxy butanol; butyraldehyde; 2-ethyl butanol; hexylene glycol; crotonaldehyde; trimethylolpropane.

CELANESE CORP. OF AMERICA, Pampa, Tex.
Raw material: Natural gas; liquefied petroleum gases (propane, butanes).
Principal products: Propionic acid; methanol; acetone; acetic acid; acetic anhydride; vinyl acetate; n-propyl acetate; n-butyl acetate; butyric acid; methyl acetone; acetate methylal; methyl ethyl ketone; ethyl acetate. New beta-propiolactone unit on stream.

CELANESE CORP. OF AMERICA, Point Pleasant, W. Va.
Raw material: Petroleum cresylic acid, phenol; propyl alcohol; ethylene oxide; butyl alcohol; isooctyl alcohol; pentaerythritol.
Principal products: Tricresyl phosphate; dialkyl phosphate; polyester plasticizers; phenyl discresyl phosphate; chlorinated phosphates; pentaerythritol esters; flame resistant hydraulic fluid.

CELANESE CORP. OF AMERICA, Houston.
Raw material: Ethylene and alpha olefins.
Principal product: Low-pressure polyolefin (40,000,000 lb. per year).

CHEMSTRAND CORP. (Monsanto Chemical Co., American Viscose Corp.), Decatur, Ala.
Raw material: Acrylonitrile.

Principal product: Acrylic fibers (45,000,000 lb. per year).

CHEMSTRAND CORP. (Monsanto Chemical Co., American Viscose Corp.), Pensacola, Fla.
Raw material: Petroleum-base stocks.
Principal product: Nylon (114,000,000 lb. per year).

COLUMBIA GAS SYSTEM, INC., Siloam, Ky.
Construction: Columbia Hydrocarbon Corp. will add facilities to produce ethylene at its fractionation plant presently being built at Siloam, Ky. Facilities will be added after completion of the fractionation plant slated for December 1, 1958. United Fuel Gas Co. will furnish hydrocarbons from the extraction plant at Kenova, W. Va.

COLUMBIA-SOUTHERN CHEMICAL CORP. (subsidiary of Pittsburgh Plate Glass Co.), Natrium, W. Va.
Raw material: Benzene.
Principal products: Monochlorobenzene; ortho-dichlorobenzene; para-dichlorobenzene; benzene hexachloride.

COLUMBIA - SOUTHERN CHEMICAL CORP. (subsidiary of Pittsburgh Plate Glass Co.), Barberton, Ohio.
Raw material: Propane.
Principal product: Perchloroethylene.

COMMERCIAL SOLVENTS CORP., Sterlington, La.
Raw material: Hydrogen; carbon monoxide.
Principal product: Methanol.
Raw material: Natural gas fractions.
Principal products: Nitroethane; nitromethane; 1-nitropropane; 2-nitropropane; nitrobutane.

CONTINENTAL OIL CO., Baltimore.
Raw material: Propylene tetramer; benzene.
Principal products: Alky aryl sulfonating stocks including dodecylbenzene.

CONTINENTAL OIL CO., Chicago.
Raw material: Dodecylbenzene.
Principal products: Water-soluble surface-active sulfonates including liquid, slurried, drum-dried, and spray-dried stocks (dodecylbenzenesulfonic acid type); oil well fracturing compounds.

CONTINENTAL OIL CO., Ponca City, Okla.
Raw material: Naphtha fraction; propylene.
Principal products: Benzene (350 bbl. per day) and toluene-xylenes mix (1,200 bbl. per day); propylene tetramer.

CONTINENTAL OIL CO., Sherwood Refining Div., Gretna, La.
Raw material: Lube-oil stocks.
Principal products: Natural sulfonates.

CONTINENTAL OIL CO., Lake Charles, La.
Raw material: Naphtha fraction.
Principal product: Benzene (300 bbl. per day) and toluene-xylenes mix 1,600 bbl. per day).
Raw material: Propylene.
Principal product: Propylene tetramer.

CONTINENTAL OIL CO., Trainer, Pa.
Raw material: Alkyl aryl sulfonating feed stock.
Principal products: Oil-soluble surface-active sulfonates (lubricating-oil detergent additive, fuel-oil additives).

COSDEN PETROLEUM CORP., Big Spring, Tex.
Raw material: Naphtha fractions.
Principal products: Benzene (180 bbl. per day); toluene (550 bbl. per day); xylenes (800 bbl. per day); ortho-xylene (99% purity); meta-xylene (85% purity); ethylbenzene; styrene monomer (20,000,000 lb. per year); polystyrene (22,000,000 lb. per year).
Raw material: Mixed olefins.
Principal product: Polybutene (1,300,000 gal. per year).

CROWN CENTRAL PETROLEUM CORP., Pasadena, Tex.,
Raw material: Refinery gas steam.
Principal product: Propane-propylene stream (sold to Shell Chemical Corp.).

D

DELHI-TAYLOR OIL CORP., Corpus Christi, Tex.
Raw material: Selected petroleum fractions.
Principal products: Benzene (1,00 bbl. per day); toluene (800 bbl. per day); and xylenes (700 bbl. per day); aliphatic solvents; heavy aromatic solvents. (Capacity of extraction unit 5,000 bbl. per day).

DIAMOND ALKALI CO., Deer Park Plant, Pasadena, Tex.
Raw material: Ethylene.
Principal products: Perchloroethylene; vinyl chloride monomer (50,000,000 lb. per year); polyvinyl chloride.
Construction: Considering a $10,000,000, 40-ton per day acetylene plant.

DIAMOND ALKALI CO., Greens Bayou Plant, Pasadena, Tex.
Raw material: Benzene.
Principal products: Benzene hexachloride; DDT.

DOW CHEMICAL CO., Freeport, Tex.
Raw material: Natural gas; liquefied petroleum gases; benzene.
Principal products: Ethylene diamine; mono, di, tri, -ethanolamines; glycerin; ethylene and propylene oxides; ethylene, -propylene, -diethylene, -dipropylene, tetraethylene, -triethylene, -tripropylene glycols; carbon tetrachloride; chloroform; dichloroethyl, -dichloroisopropyl ether; styrene, ethyl benzene; ethyl, -methyl, -methylene chlorides; vinyl, -vinylidene chlorides; ethylene, -ethylidene, -propylene dichlorides; methyl chloroform; perchloroethylene; styrene-butadiene latex; polyethylene; trichloroethylene; allyl alcohol and allyl chloride.
Construction: Will complete first quarter 1959, an acrylonitrile plant.

DOW CHEMICAL CO., Midland, Mich.
Raw material: Crude oil, natural gas; benzene.
Principal products: Ethylene; propylene; styrene; methyl styrene; ethylene glycol; ethyl benzene; ethyl chloride; ethylene dibromide; diethylbenzene; polystyrene; divinylbenzene; ethylene dichloride; ethylene oxide; mono-, di-, -tri ethanolamines; ethylene diamine; i-propylbenzene (cumene); i-propyl chloride; propylene oxide; propylene dichloride; i-propanolamines; toluene 2°; polyglycols; glycol ethers; styrene-butadiene latex; polyvinyl chloride; vinyltoluene; vinylidene chloride polymer.

DOW CHEMICAL CO., Pittsburg, Calif.
Raw material: Natural gas.
Principal products: Methylene chloride; methyl chloride; chloroform; carbon tetrachloride; perchloroethylene; styrene-butadiene latex.

DOW CHEMICAL CO., Torrance, Calif.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Allyn's Point, Conn.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Pevely, Mo.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Ironton, Ohio.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Lee Hall, Va.
Construction: Has completed 12,000,000 lb. per year "nitrile alloy" (acrylic) fiber facilities.

DOW CHEMICAL CO., Plaquemine, La.
Raw material: Liquid petroleum gas.
Principal products: Ethylene; propylene; glycols; vinyl chloride and other chlorinated hydrocarbons and related products.

DOW CHEMICAL CO., Bay City, Mich.
Construction: Will complete in 1959, facilities to produce ethylene and butadiene from refinery streams. Multimillion-dollar polyethylene facilties will be added by October 1959.

DU PONT, E. I., DE NEMOURS & CO., Orange, Tex.
Raw material: Natural gas; propane; benzene; cyclohexane; adiponitrile.
Principal products: Methanol; polyethylene; nylon intermediates; adipic acid; hexamethylene-diamine. (Ethylene made from gas and/or propane is used internally).

DU PONT, E. I., DE NEMOURS & CO., La Porte, Tex.
Raw material: Methanol.
Principal products: Carbamate fungicides; methylamines; dimethyl formamide.

DU PONT, E. I., DE NEMOURS & CO., Victoria, Tex.
Raw material: Natural gas; butadiene.
Principal product: Adiponitrile (nylon salt basic).

DU PONT, E. I., DE NEMOURS & CO., Memphis, Tenn.
Raw material: Natural gas.
Principal products: Hydrogen cyanide; sodium cyanide.

DU PONT, E. I., DE NEMOURS & CO., Antioch, Calif.
Raw material: Petroleum base stock.
Principal products: Tetraethyl lead; fluorinated hydrocarbons.

DU PONT, E. I., DE NEMOURS & CO., Beaumont, Tex.
Raw material: Ethylene.
Principal products: Chlorosulfonated polyethylene synthetic rubber, menthionine.

DU PONT, E. I., DE NEMOURS & CO., Parkersburg, W. Va.
Contsruction: Will complete mid-1959, acetal resin facilities.

D-X SUNRAY OIL CO., Duncan, Okla.
Raw material: Refinery gases.
Principal product: Propylene tetramer.

E

EASTERN STATES PETROLEUM & CHEMICAL CORP., Houston.
Raw material: Refinery stream.
Principal products: Benzene (1,350 bbl. per day); toluene (985 bbl. per day); xylene (1,260 bbl. per day); aromatic and aliphatic solvents.
Construction: Will complete late 1958, a 600-bbl. per day UOP aromatic alkylation unit.

ESCAMBIA CHEMICAL CORP., Pensacola, Fla.
Raw material: Natural gas.
Principal products: Methanol (16,000,000 gal. per year); polyvinyl chloride (30,000,000 lb. per year).

ESSO STANDARD OIL CO., Baton Rouge, La.
Raw material: Natural gas; refinery gas streams; liquid fractions.
Principal products: Aromatic distillates and solvents (benzene, 600 bbl. per day); aromatic tars; ethane, ethylene; propane, propylene; isobutylene; isoprene; tripropylene; ethanol; isopropanol; isooctanol; decanol; tridecanol; ethyl ether; isopropyl ether; dicyclopentadiene; benzene; tetrapropylene; acetone (from isopropyl alcohol); petroleum resins; normal butylene.

ESSO STANDARD OIL CO., Linden, N. J.
Raw material: Refinery-gas streams; liquid fractions.
Principal products: Ethylene; naphthenic acids; isobutylene; polyisobutylenes; isopropanol; sec.-butanol; isopropyl acetate; sec.-dibutyl acetate; methyl ethyl retone; acetone; isopropyl ether; lube-oil additives.

ETHYL CORP., Baton Rouge, La.
Raw material: Ethane; ethylene.
Principal products: Tetraethyl lead; ethyl chloride; ethylene dichloride; vinyl chloride monomer.

ETHYL CORP., Pasadena, Tex.
Raw material: Ethylene.
Principal products: Tetraethyl lead; ethyl chloride; ethylene dichloride.

ETHYL CORP., Pittsburg, Calif.
Raw material: Ethylene.
Principal products: Tetraethyl lead.

ETHYL-DOW CHEMICAL CO., INC., Freeport, Tex.
Raw material: Ethylene.
Principal product: Ethylene dibromide.

F

FIRESTONE PLASTIC CO., Div. of Firestone Tire & Rubber Co., Pottstown, Pa.
Raw material: Petroleum base stocks.
Principal products: Polybutadiene-acrylonitrile type (N-type) acrylic elastomers; polybutadiene-styrene type acrylic elastomers; vinyl resins.

FOOD MACHINERY & CHEMICAL CORP., South Charleston, W. Va.
Raw material: Methane (natural gas).
Principal product: Carbon tetrachloride.

FOOD MACHINERY & CHEMICAL CO., Chemicals & Plastics Division, Nitro, W. Va.
Raw material: Petroleum cresylic acid.
Principal products: Tricresyl phosphate; plasticizers (also diisooctyl phthalate and diallyl phthalate monomer from isooctyl, allyl, and other alohols).

FOSTER GRANT CO., INC., Baton Rouge, La.
Raw material: Benzene; ethylene.
Principal product: Styrene.
Contsruction: Expanding styrene capacity to 105,000 lb. per year.

FOSTER GRANT CO., INC., Leominster, Mass.
Raw material: Styrene monomer.
Principal product: Polystyrene.

FOSTER GRANT CO., INC., Manchester, N. H.
Raw material: Caprolactam.
Principal product: Nylon 6 molding powder.

FRONTIER OIL REFINING CO., Div. of Ashland Oil & Refining Co., North Tonawanda, N. Y.
Raw material: Naphtha fraction.
Principal products: Benzene (300 bbl. per year); toluene, xylenes, and heavy aromatics (800 bbl. per day).

G

GENERAL ANILINE & FILM, Linden, N. J.
Raw material: Ethylene.
Principal products: Ethylene oxide (60,000,000 lb. per year); ethylene glycol (35,000,000 lb. per year).

GENERAL PETROLEUM CORP., Torrance, Calif.
Raw material: Refinery streams.
Principal products: Sodium cresylate sludge; hydrogen sulfide (in commercial amine solution); crude naphthenic acids. (Crude naphthenic acids are processed into highly refined naphthenic acids and metallic naphthenates at the Vernon process products plant at Los Angeles).

GENERAL PETROLEUM CORP., Ferndale, Wash.
Raw material: Refinery streams.
Principal product: Sodium sulfide sludge.

GENERAL TIRE & RUBBER CO., Mogadore, Ohio.
Raw material: Butadiene; styrene; other petroleum-derived materials.
Principal products: Polybutadiene-styrene latices; vinyl pyridine type acrylic latices; polyurethane elastomers.

GENERAL TIRE & RUBBER CO., Ashtabula, Ohio.
Raw material: Acetylene.
Principal product: Polyvinyl chloride.

GOODRICH, B. F., CHEMICAL CO., Calvert City, Ky.
Raw material: Petroleum base stocks.
Principal products: Special rubbers including acrylonitrile-butadiene, brominated butyl, carboxylic nitrile, liquid SBR (formerly GR-S), butadiene-styrene, and polyacrylic rubber.

GOODRICH, B. F., CHEMICAL CO., Akron, Ohio.
Raw material: Petroleum base stocks.
Principal products: Butadiene-acrylonitrile (N-type); acrylic rubber.

GOODRICH, B. F., CHEMICAL CO., Avon Lake, Ohio.
Raw material: Alcohols; vinyl chloride.
Principal products: Plasticizers; polyvinyl chloride resins and compounds.

GOODRICH, B. F., CHEMICAL CO., Louisville, Ky.
Raw material: Petroleum base stocks.
Principal products: Butadiene-acrylonitrile rubbers; other rubbers.

GOODYEAR TIRE & RUBBER CO., Chemical Div., Akron, Ohio.
Raw material: Petroleum base stocks.
Principal products: Butadiene acrylonitrile (N-type) elastomers (rubber and latices); high-styrene-type (paint bases, rubber reinforcers, molding resins); styrenated products; butadiene-styrene elastomers (rubbers and latices); vinyl chloride polymers (resins and latices).
(Goodyear also makes vinyl chloride polymers; alkyl and aryl organic-rubber-processing chemicals; and butadiene-styrene and butadiene-acrylonitrile rubbers and resins at other plants.

GOODYEAR TIRE & RUBBER CO., Point Pleasant, W. Va.
Construction: Will complete March 1959, a $9,000,000 GR and R plant to manufacture polyester resins (unofficially reported as dimethyl terephthalate-dimethyl isophthalate; also base for Beaunit Mills 10,000,000-lb. per year polyester fiber facilities at Elizabeth, Tenn.).

GRACE, W. R., CO., Grace Chemical Div., Baton Rouge, La.
Raw material: Ethylene.
Principal product: Polyethylene.

GRACE, W. R., CO., Dewey and Almy Div., Owensboro, Ky.
Construction: Building a $4,000,000 plant to manufacture styrene-butadiene latices.

GREAT SOUTHERN CHEMICAL CORP. (Pontiac Refining Corp., La Gloria Oil & Gas Corp., Gulf Oil Corp.), Corpus Christi, Tex.
Raw material: Naphtha fractions.
Principal products: Benzene toluene; xylenes.

GREAT WESTERN PRODUCERS, INC. (formerly Petrocarbon Chemicals, Inc.), Irving, Tex.
Raw material: Distillate and crude oil.
Principal products: Aromatic solvents; aliphatic solvents; gasolines; diesel fuel.
Construction: Plans to add a Udex unit to make pure benzene, toluene, and xylenes.

GULF OIL CORP., Port Arthur, Tex.
Raw material: Refinery gases; refinery streams; heptenes; propane; butane.
Principal products: Ethylene; propylene;

butylenes; isooctyl alcohol; propylene trimer; propylene tetramer; light isooctyl alcohol; octyl polymer; aromatic distillate.
Construction: Will complete late 1958 or early 1959, UOP facilities for 30,000,000 gal. per year of benzene in a $6,800,000 project.

GULF OIL CORP., (formerly Warren Petroleum Co.), Conroe, Tex.
Raw material: Propane.
Principal products: Pentaerythritol; acetaldehyde; methanol; sodium formate.

H

HAWTHORNE CHEMICAL CORP. (Hercules Powder Co., Imperial Chemical Industries, Ltd.), Louisiana, Mo.
Construction: Has postponed indefinitely plans for $6,000,000 of facilities for formaldehyde, pentaerythritol, and methanol, and an $11,000,000, 35,000,000-lb. per year monomethyl methacrylate and polymer plant.

HERCULES POWDER CO., Louisiana, Mo.
Raw material: Natural gas.
Principal products: Methanol (70 tons per day); formaldehyde (100,000,000 lb. per year); pentaerythritol (24,000,000 lb. per year).

HERCULES POWDER CO., Gibbstown, N. J.
Raw material: Propylene; benzene.
Principal products: Phenol; acetone; cumene; cumene hydroperoxide; acetophenone; a-methylstyrene.

HERCULES POWDER CO., Parlin, N. J.
Raw material: Ethylene.
Principal product: Polyethylene (Ziegler process, 30,000,000 lb. per year).
Raw material: Propylene.
Principal product: Polypropylene (20,000,000 lb. per year; first commercial plant in North America).

HEYDEN CHEMICAL CORP., Texas City, Tex.
(Part owner with Monsanto Chemical Co. in methanol plant. See Monsanto, Texas City, Tex., listing).

HOOKER CHEMICAL CORP. (formerly Hooker Electrochemical Co.), Niagara Falls, N. Y.
Raw material: Pentane; petroleum waxes.
Principal products: Chlorinated waxes; hexachlorocyclopentadiene; isophthaloyl chloride; terephthaloyl chloride.

HUMBLE OIL & REFINING CO., Baytown, Tex.
Raw material: Refinery streams.
Principal products: Benzene (2,500 bbl. per day); toluene (5,000 bbl. per day); solvent xylene (5,500 bbl. per day); paraxylene (600 bbl. per day); orthoxylene; high boiling range aromatic solvents; ethylene; propylene concentrate; normal butylenes; isobutylene; pentylene concentrate; tripropylene; tetrapropylene; narrow-boiling-range aliphatic naphthas (hexane, heptane, octane); cyclohexane; special naphthas; aromatic quench oil; carbon-black feed stock.
Construction: Will complete third quarter 1958, expansion of paraxylene unit. Capacity of ethylene will be doubled later.

I

INDEX CHEMICAL CO. (subsidiary of Pensalt Chemicals Co.), Houston.
Raw materials: Natural gas; butane; methyl alcohol; ethyl alcohol; sulfur.
Principal products: Methyl mercaptan; ethyl mercaptan; thiophene; butyl mercaptan; tetrahydrothiophene; octyl mercaptan.

J

JEFFERSON CHEMICAL CO., INC., Port Neches, Tex.
Raw material: Refinery gases (ethane, propane streams); propylene polymer; phenol; ammonia; tridecyl alcohol.
Principal products: Piperazine; ethylene oxide-tridecyl alcohol condensates; ethylene, diethylene, triethylene glycols; polyethylene glycols; ethanolamines; ethylene carbonate; propylene carbonate; morpholine; nonyl phenol; ethylene oxide-nonyl phenol condensates. (Ethylene made from refinery gases and/or LPG is used internally).
Construction: Has under way a $38,000,000 expansion program. Ethylene capacity will be 180,000,000 lb. per year. Slated for completion October 1958 are direct oxidation units to produce 165,000,000 lb. per year of ethylene oxide, and facilities to produce 126,000,000 lb. per year of ethylene glycol. Facilities for ethylene chloride, chlorine, propylene oxide-glycol and other propylene derivatives will be added, and ethylene oxide specialties and morpholine will be expanded by early 1959.

JEFFERSON LAKE SULPHUR CO., Merichem Div., Houston.
Raw material: Refinery treating wastes.
Principal products: Phenol; cresols; cresylic acid (200,000 gal. per month); sodium sulfide.

K

KENDALL REFINING CO., Bradford, Pa.
Raw material: Petroleum fractions.
Principal products: Heavy hydrocarbons (petroleum polymer and condensation resins).

KOPPERS CO., INC., Plastics Div., Port Arthur, Tex.
Raw material: Ethylene.
Principal products: Ethylbenzene; polyethylene.
Construction: Plans to double polyethylene capacity.

KOPPERS CO., INC., Plastics Div., Kobuta, Pa.
Raw material: Ethylbenzene.
Principal products: Styrene; polystyrene; polyethylene (Ziegler process); expandable polystyrene beads.

KOPPERS CO., INC., Plastics Div., Woodridge Township, N. J.
Raw material: Ethylene (from Esso Bayway plant via pipeline).
Principal product: Polyethylene (30,000,000 lb. per year).

L

LEONARD REFINERS, INC., Roosevelt Div., Mount Pleasant, Mich.
Raw material: Naphtha fraction.
Principal products: Benzene (250 bbl. per day); toluene (250 bbl. per day); xylene concentrates (30 bbl. per day).

LUBRIZOL CORP., Pasadena, Tex.
Raw material: Petroleum fractions.
Principal products: Petroleum sulfonates (barium and calcium salts); other lube oil additives.

LUBRIZOL CORP., Cleveland, Ohio.
Raw material: Petroleum fractions.
Principal products: Petroleum sulfonate; lube-oil additives.

M

MAGNOLIA PETROLEUM CO., Beaumont, Tex.
Raw material: Petroleum fractions.
Principal products: Cresylic acid; sodium cresylate solutions.

MARBON CHEMICAL, Div. of Borg-Warner Corp., Gary, Ind. (2 plants).
Raw material: Acrylonitrile; butadiene; styrene.
Principal products: High-styrene resins; high impact thermoplastic molding material.

MARBON CHEMICAL, Div. of Borg-Warner Corp., Parkersburg, W. Va.
Raw material: Styrene; acrylonitrile; butadiene.
Principal products: High impact thermoplastic resins.

MERICHEM CO. OF OKLAHOMA formerly Brin Chemicals, Tulsa, Okla.
Note: Facilities for recovering acid oils (phenols, cresols, xylenols) have been purchased by Merichem, and are presently shut down.

MONSANTO CHEMICAL CO., Organic Chemicals Div., Avon, Calif.
Raw material: Benzene.
Principal product: Phenol (by sulfonation).

MONSANTO CHEMICAL CO., Organic Chemicals Div., Luling, La.
Raw material: Petroleum derived fractions.
Principal product: Nylon intermediate (adipic acid processing).

MONSANTO CHEMICAL CO., Plastics Div., Texas City, Tex.
Raw material: Natural gas; propane; benzene.
Principal products: Ethylbenzene; styrene; ethylene dichloride; vinyl chloride; acrylonitrile; hydrogen cayanide; toluene-2°; tertiarybutylamine. (Acetylene and ethylene made at Texas City are employed internally).
Raw material: Ethylene.
Principal product: Polyethylene.
Construction: Will expand by end of 1958, acrylonitrile capacity to 100,000,000 lb. per year; styrene monomer capacity from 320,000,000 to 360,000,000 lb. per year; acetylene capacity by 12,000,000 lb. per year.

MONSANTO CHEMICAL CO. and HEYDEN CHEMICAL CORP., Texas City, Tex.
Raw material: Byproduct hydrogen; carbon monoxide from acetylene synthesis.
Principal product: Methanol.

MONTROSE CHEMICAL CO., Newark, N. J.
Raw material: Petroleum cresylic acid.
Principal products: Tricresyl phosphate; diphenyl monocresyl phosphate.

N

NATIONAL PETRO-CHEMICALS CORP., (subsidiary of National Distillers and Chemicals Corp.), Tuscola, Ill.
Raw material: Natural gas (ethane); ethylene.
Principal products: Ethanol; ethyl ether; ethyl chloride; polyethylene.

NATIONAL PETRO-CHEMICALS CORP. (subsidiary of National Distillers and Chemicals Corp.), Houston Ship Channel.
Construction: Will complete early 1959, a 75,000,000-lb. per year polyethylene plant. Estimated cost $20,000,000. High-purity ethylene will come from Phillips' Sweeny plant.

NATURAL GAS ODORIZING, INC., Houston.
Raw material: Crude mercaptans (ethyl and higher).
Principal products: Odorants for natural gas and LPG.

NAUGATUCK CHEMICAL, Div. of U. S. Rubber Co., Naugatuck, Conn.
Raw material: Styrene; butadiene.
Principal products: Butadiene-styrene copolymers.

NAUGATUCK CHEMICAL, Div. of U. S. Rubber Co., Baton Rouge, La.
Raw material: Styrene; butadiene; acrylonitrile.
Principal products: N-type rubber; styrene copolymers and latices; rubber-resin blends.

NEVILLE CHEMICAL CO., Neville Island, Pa.
Raw material: Unsaturated petroleum fractions.
Principal products: Aromatic petroleum solvents; heat-reactive resins; thermoplastic resins.

NEVILLE CHEMICAL CO., Anaheim, Calif.
Raw material: Unsaturated petroleum fractions.
Principal products: Aromatic petroleum solvents; heat-reactive resins; thermoplastic resins.

NOPCO CHEMICAL CO., Griffin Chemical Div., Richmond, Calif.
Raw material: Petroleum fractions.
Principal products: Naphthenic acid; petroleum sulfonates (emulsifying agents).

O

ODESSA STYRENE CO. (El Paso Natural Gas Products Co., and United Carbon Co.), Odessa, Tex.
Construction: Has completed styrene plant.

OLIN-MATHIESON CHEMICAL CORP., Brandenburg, Ky.
Raw material: Natural-gas liquids (ethane).
Principal products: Ethylene oxide; ethylene; diethylene and triethylene glycols; polyethylene glycols; ethylene dichloride; ethylene diamine; ethylene glycol ethers; ethanolamines; diechloroethyl ether; aromatic distillates and solvents; nonionic surface active agents (aliphatic polyoxyethylene ether alcohols); pour-point depressant and v. i. improver for lube oil.

ORONITE CHEMICAL CO. (subsidiary of Standard Oil Co. of California), Oak Point, La.
Raw material: Petroleum base stocks.
Principal products: Lube-oil additives; furnace-oil additive; gas odorants; nonionic detergents; algicides; alkyl phenols; grease additive; diesel-fuel additive.

P

PENNSALT CHEMICALS CORP., Wyandotte, Mich.
Raw material: Pentane; pentane fractions; triisobutylene.
Principal products: Amyl alcohol; amyl chloride; amyl acetate; amyl phenols; amly naphthalenes; n-alkyl mercaptans; tertiary dodecyl mercaptan; polyethylene glycol tert-dodecyl thioether; 2-pentene; mixed pentenes; thiophene; tetene; mixed pentenes; thiophene; tetrahydrothiophene; carbon disulfide.

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP., Chester, Pa.
Raw material: Petroleum base stocks.
Principal products: Petroleum polymer; condensation resins.
(New hydrocarbon resins and aromatics plant on stream at West Elizabeth, Pa.)

PENNSYLVANIA REFINING CO., Karns City, Pa.
Raw material: Finished and semifinished lube oil and distillates.
Principal products: Petroleum sulfonates.

PETROLEUM CHEMICALS, INC. (Cities Service Co. and Continental Oil Co.), Lake Charles, La.
Raw material: Petroleum feed stocks.
Principal products: Ethylene (200,000,000 lb. per year, expandable to 300,000,000 lb.); propylene (40,000,000 lb. per year); aromatic distillate (500,000 bbl. per year).

PETRO-TEX CHEMICAL CORP., Houston.
Raw material: Petroleum base stock.
Principal products: Butene-1; butene-2; diisobutylene; triisobutylene; 3 methyl butene-1.
Construction: Will complete December 1958, a 3,000-bbl. per day sulfuric acid alkylation unit to make alkylate from butylenes.

PETRO-TEX CHEMICAL CORP., Houston, Tex.
Construction: Will complete December 1958, a 2,000,000-gal. per year isobutylene unit.

PHILLIPS CHEMICAL CO., Pasadena, Tex.
Raw material: Methylethylpyridine.
Principal product: Methylvinylpyridine (3,700,000 lb. per year).
Raw material: Ethylene.
Principal product: Polyethylene (75,000,000 lb. per year).

PHILLIPS CHEMICAL CO., Sweeny, Tex.
Raw material: Butane.
Principal product: Ethylene (180,000,000 lb. per year).

PHILLIPS CHEMICAL CO., Phillips, Tex.
Raw material: Petroleum fractions.
Principal products: Tert-butyl mercaptan; tert-dodecyl mercaptan; other sulfur chemicals; odorless thinners; other chemical specialties.

PHILLIPS CHEMICAL CO. (operated by Cosden Petroleum Corp.), Big Spring, Tex.
Raw material: Mixed xylene.
Principal product: Paraxylene (5,300,000 lb. per year).

PHILLIPS PETROLEUM CO., Kansas City, Kans.
Raw material: Petroleum fractions.
Principal products: Rubber extender and process oils.

PHILLIPS PETROLEUM CO., Phillips, Tex.
Raw material: Petroleum fractions.
Principal products: Diisopropyl; cyclohexane; hydrogen sulfide; ethyl mercaptan.

PROCESSORS, INC., and OIL & CHEMICAL PRODUCTS, INC., Galena Park, Tex.
Raw material: Petroleum fractions.
Principal products: Benzene; toluene; xylenes; aromatic solvent naphthas; odorless paint thinners; DDT base.

PRODUCTOL CO., Santa Fe Springs, Calif.
Raw material: Refinery byproduct fractions.
Principal products: Phenols; cresols; cresylic acids.

PURE OIL CO., Smiths Bluff, Tex.
Raw material: Petroleum fractions; refinery-gas streams.
Principal products: Petroleum polymer; condensation resins; solvents; nonparaffin concentrates; 1-butene; 2-butene and mixtures.

PURE OIL CO., Toledo, Ohio.
Raw material: Petroleum fractions.
Principal products: Solvents; toluene-2°; (620 bbl. per day); xylene (aviation grade); heavy mixed aromatics; polymers. (Capacity of mixed xylenes—1,260 bbl. per day).

R

REICHHOLD CHEMICALS, INC., Elizabeth, N. J.
Raw material: Benzene.
Principal product: Maleic anhydride.
Raw material: Formaldehyde; USP phenol.
Principal product: Phenol-formaldehyde resins; urea-formaldehyde resins.
Raw material: Styrene.
Principal product: Polyester resins; styrenated alkyd resins.
Raw material: Vinyl acetate monomer.
Principal product: Polyvinyl acetate emulsions.
Raw material: Glycerin (synthetic).
Principal products: Alkyd resins; ester gum.

REICHHOLD CHEMICALS, INC., Ballardvale, Mass.
Raw material: Formaldehyde; USP phenol.
Principal products: Phenol-formaldehyde resins; urea-formaldehyde resins.
Raw material: Methanol (from natural gas).
Principal product: Formaldehyde.
Raw material: Bis-phenol; acetone; epichlorhydrin.
Principal product: Epoxy resins (10,000,-

000 lb. per year of liquid and solid epoxies).

REICHHOLD CHEMICALS, INC., Detroit.
Raw material: Formaldehyde; USP phenol.
Principal products: Phenol-formaldehyde resins; urea-formaldehyde resins.
Raw material: Styrene.
Principal products: Polyester resins; styrenated alkyd resins.
Raw material: Petroleum solvents.
Principal product: Alkyd resin solutions.
Raw material: Glycerin (synthetic).
Principal product: Alkyd resins.
Raw material: Normal butyl alcohol.
Principal product: Butylated urea-formaldehyde resins.

REICHHOLD CHEMICALS, INC., Charlotte, N. C.
Raw material: Methanol (from natural gas).
Principal product: Formaldehyde.
Raw material: Formaldehyde.
Principal product: Urea-formaldehyde resins.
Raw material: Vinyl acetate monomer.
Principal product: Polyvinyl acetate emulsions.

REICHHOLD CHEMICALS, INC., Kansas City, Kans.
Raw material: Formaldehyde; USP phenol.
Principal product: Phenol-formaldehyde resins.
Raw material: Vinyl acetate monomer.
Principal product: Polyvinyl acetate emulsions.

REICHHOLD CHEMICALS, INC., Tuscaloosa, Ala.
Raw material: Methanol (from natural gas).
Principal product: Formaldehyde.
Raw material: Benzene.
Principal product: USP phenol.
Raw material: Formaldehyde; acetaldehyde; USP phenol.
Principal products: Pentaerythritol; phenol-formaldehyde resins; urea-formaldehyde resins.
Raw material: Petroleum solvents.
Construction: Doubling capacity of formaldehyde. A $1,500,000 program is under way to expand production of phenol from benzene, with completion slated for 1959. Another $1,500,000 program is under way to expand production of pentaerythritol from formaldehyde and acetaldehyde.

REICHHOLD CHEMICALS, INC., Hampton, S. C.
Raw material: Methanol (from natural gas).
Principal product: Formaldehyde.

REICHHOLD CHEMICALS, Azusa, Calif.
Raw material: Formaldehyde; USP phenol.
Principal product: Phenol-formaldehyde resins.
Raw material: Petroleum solvents.
Principal product: Alkyd resin solutions.
Raw material: Styrene.
Principal product: Polyester resins.

REICHHOLD CHEMICALS, INC., Jacksonville, Fla.
Raw material: Formaldehyde.
Principal product: Urea-formaldehyde resins.

REICHHOLD CHEMICALS, INC., South San Francisco, Calif.
Raw material: Formaldehyde; USP phenol.
Principal products: Phenol-formaldehyde resins; urea-formaldehyde resins.
Raw material: Petroleum solvents.
Principal product: Alkyd resin solutions.
Raw material: Vinyl acetate monomer.
Principal product: Polyvinyl acetate emulsions.

REICHHOLD CHEMICALS, INC., Seattle, Wash.
Raw material: USP phenol; formaldehyde.
Principal product: Pentachlorophenol; phenol-formaldehyde resins.
Raw material: Methanol (from natural gas).
Principal product: Formaldehyde.

REICHHOLD CHEMICALS, INC., Tacoma, Wash.
Raw material: Methanol (from natural gas).
Principal product: Formaldehyde.
Raw material: Formaldehyde; USP phenol.
Principal products: Phenol-formaldehyde resins; pentachlorophenol.

REILLY TAR & CHEMICAL CORP., Indianapolis, Ind.
Raw material: Petroleum fractions.
Principal products: Phenols; cresols.

REPUBLIC OIL & REFINING CO., Div. of Plymouth Oil Co., Texas City, Tex.
Raw material: Refinery-gas streams.
Principal products: Butane and butylenes; ethylene, propylene tetramer; propylene trimer.
Construction: Has temporarily shelved plans for a 5,000-bbl. per day Udex unit to produce benzene, toluene, and xylenes.

RICHFIELD OIL CORP., Wilmington, Calif.
Raw material: Petroleum fractions.
Principal products: Naphthenic acids.
Raw material: Refinery cracked gases.
Principal product: Ethylene-ethane stream.
Raw material: C_6 and C_7 naphthenes (Selected straightrun gasoline fraction).
Principal products: Benzene; toluene (Capacities 18,000,000 gal. per year of each product). Mixed xylenes—335 bbl. per day.

ROHM & HAAS CO., Pasadena (Deer Park), Tex.
Raw material: Natural gas; ammonia.
Principal product: Methanol; acetylene; carbon monoxide; hydrogen; hydrogen cyanide.
Raw material: Hydrogen cyanide; acetone.
Principal product: Acetone cyanohydrin.
Raw material: Methanol; acetone cyanohydrin.
Principal product: Methyl methacrylate.
Raw material: Acetylene; carbon monoxide; (methanol and ethanol).
Principal products: Methyl and ethyl acrylate.

S

SHELL CHEMICAL CORP., Houston.
Raw material: Petroleum hydrocarbons (propylene, ethylene, butylenes).
Principal products: Acetone; diacetone alcohol; ethyl alcohol; hexylene glycol; isopropyl alcohol; isopropyl ether; mesityl oxide; methyl ethyl ketone; methyl isobutyl carbinol; methyl isobutyl ketone; sec-butyl alcohol; allyl alcohol; allyl chloride; epichlorohydrin; ethyl chloride; glycerin; epoxy resins; soil fumigant; (chlorinated C_3 hydrocarbons); trichloropropane; bisphenol-A; glycidyl ether.

SHELL CHEMICAL CORP., Denver.
Raw material: Petroleum hydrocarbons.
Principal products: Insecticide; agricultural chemicals; Nemagon soil fumigant (nematocide; methyl parathion).

SHELL CHEMICAL CORP., Norco, La.
Raw material: Petroleum hydrocarbons.
Principal products: Crude chlorohydrins; allyl chloride; DD soil fumigant (chlorinated C_3 hydrocarbons); hydrogen peroxide; sec.-butyl alcohol.
Construction: Will complete late 1959, facilities to make acrolein and 35,000,000 bbl. per year of glycerin at a cost of over $10,000,000.

SHELL CHEMICAL CORP: Dominguez, Calif.
Raw material: Petroleum hydrocarbons.
Principal products: Isopropyl alcohol; acetone; methyl ethyl ketone; methyl isobutyl ketone; diacetone alcohol; sec.-butyl alcohol; mesityl oxide; methyl isobutyl carbinol.

SHELL CHEMICAL CORP., Martinez, Calif.
Raw material: Petroleum hydrocarbons.
Principal products: Isopropyl alcohol; acetone; methyl ethyl ketone; methyl isobutyl ketone; ethyl amyl ketone; sec.-butyl alcohol; tert-butyl alcohol; trisubstituted phenol (2, 6-ditertiary-butyl-4-methyl-phenol—used as antitoxidant); p-tert-butyl benzoic acid; ditertiary butyl peroxide; mono-, di-and triallylamines.

SHELL OIL CO., Houston.
Raw material: Naphtha fractions.
Principal products: Benzene-2° (1,000 bbl. per day); toluene-1° (2,200 bbl. per day).

SHELL OIL CO., Martinez, Calif.
Raw material: Refinery streams.
Principal products: Petroleum sulfonates (sodium salt).

SHELL OIL CO., Wilmington, Calif.
Raw material: Refinery streams.
Principal products: Xylene-3° (800 bbl. per day—blocked operation); cyclohexane; toluene (900 bbl. per day—blocked operation); cresylic acid.

SHELL OIL CO., Wood River, Ill.
Raw material: Naphtha fractions.
Principal products: Toluene (1,200 bbl. per day—blocked operation); xylenes (1,400 bbl. per day—blocked operation).

SINCLAIR CHEMICALS, INC., East Chicago, Ind.
Raw materials: Petroleum fractions.
Principal products: Antioxidants; aromatic solvents; gear-oil additives; turbine-oil additives; cutting-oil additives; cresylic acids.

SINCLAIR CHEMICALS, INC., Sand Springs, Okla.
Raw material: Petroleum fractions.
Principal products: Demulsifying agents; corrosion inhibitors; acid-layer-type petroleum sulfonate (sodium salt); oil-

layer-type petroleum sulfonate (sodium salt).

SINCLAIR CHEMICALS, INC., Marcus Hook, Pa.
Raw material: Petroleum streams.
Principal products: Dodecene; cresylic acids.
Raw material: Catalytic reformate.
Principal products: Aromatic hydrocarbons (toluene—400 bbl. per day, paraxylene [12,000,000 lb. per year], xylene solvents—1,000 bbl. per day, heavy aromatic solvents).
Raw material: Refinery gas.
Principal product: Propylene (high-purity).

SINCLAIR CHEMICALS, INC., Houston.
Raw material: Petroleum fractions.
Principal products: Oil-layer-type petroleum sulfonates (barium, calcium, sodium salts); corrosion inhibitors; isoparaffinic odorless solvents; cresylic acids.
Construction: Will complete first quarter 1959, a $6,000,000 50,000,000-lb. per year paraxylene plant. It will produce 60,000,000 lb. per year of pure toluene and xylenes.

SINCLAIR CHEMICALS, INC., Corpus Christi, Tex.
Raw material: Petroleum fractions.
Principal products: Aromatic solvents.

SINCLAIR CHEMICALS, INC., Hartford, Ill.
Raw material: Petroleum fractions.
Principal products: Aromatic solvents.

SOCONY MOBIL OIL CO., INC., Casper, Wyo.
Raw material: Petroleum fractions.
Principal products: Select aromatic oils.

SOCONY MOBIL OIL CO., INC., Augusta, Kans.
Raw material: Petroleum fractions.
Principal products: Select aromatic oils.

SOCONY MOBIL OIL CO., INC., Paulsboro, N. J.
Raw material: Petroleum fractions.
Principal products: Sodium cresylate solutions; sodium sulfide solutions; propylene.

SOCONY MOBIL OIL CO., INC., East St. Louis, Ill.
Raw material: Refinery streams.
Principal products: Sodium cresylate solutions.

SOCONY MOBIL OIL CO., INC., East Chicago, Ind.
Raw material: Refinery streams.
Principal products: Sodium cresylate solutions; hydrogen.

SOCONY MOBIL OIL CO., INC., Buffalo, N. Y.
Raw material: Petroleum fractions.
Principal products: Sodium sulfide solutions; sodium cresylate solutions.

SOCONY MOBIL OIL CO., INC., Brooklyn, N. Y.
Raw material: Petroleum fractions.
Principal products: Sodium cresylate solutions.

SONNEBORN, L., SONS, INC., Daugherty Refinery, Petrolia, Pa.
Raw material: Petroleum fractions.
Principal products: Oil-layer type of petroleum sulfonate (sodium and alkaline earth salts); water-soluble petroleum sulfonate.

SPENCER CHEMICAL CO., Henderson, Ky.
Raw material: Caprolactam.
Principal product: Nylon-6 molding resins.

SPENCER CHEMICAL CO., Orange, Tex.
Raw material: Ethylene.
Principal product: Polyethylene (90,000,-lb. per year).

SPENCER CHEMICAL CO., Pittsburg, Kans.
Raw material: Natural gas.
Principal product: Methanol.

SPENCER CHEMICAL CO., Calumet City, Ill.
Raw material: Methanol and ammonia.
Principal product: Formaldehyde and hexamine (hexamethylene tetramine).

STANDARD OIL CO. OF CALIFORNIA, El Segundo, Calif.
Raw material: Petroleum base stocks.
Principal products: Benzene (1,500 bbl. per day); toluene; paraxylene; cumene; butadiene-butylene mixtures.

STANDARD OIL CO. OF CALIFORNIA, Richmond, Calif.
Raw material: Petroleum base stocks; natural gas.
Principal products: Orthoxylene; metaxylene; paraxylene; industrial xylenes; alkyl aromatic detergents in various forms; metallic naphthenates; naphthenic acids; cresylic acids; petroleum sulfonates; polybutenes; gas odorants; ethyl mercaptans; isophthalic acid; phthalic anhydride; phenol; acetone; benzoic-toluic acid.
Construction: Has under way a $1,750,000 polybutene expansion program.

STANDARD OIL CO. (IND.), Wood River, Ill.
Raw material: Heptene and nonene from olefin feed.
Principal products: Isooctyl; decyl or higher alcohols.
Raw material: Petroleum fractions.
Principal products: Polybutene and high-molecular-weight hydrocarbons; sodium cresylate; lube oil detergent and corrosion inhibitor additives; petroleum base plasticizers; gasoline and distillate-fuel additives.

STANDARD OIL CO. (IND.), Sugar Creek, Mo.
Raw material: Petroleum fractions.
Principal products: Heptene concentrate; sodium cresylate.

STANDARD OIL CO. (IND.), Whiting, Ind.
Raw material: Petroleum fractions.
Principal products: Benzene-1° (1,100 bbl. per day); nitration-grade toluene (1,870 bbl. per day) and xylenes-10° (925 bbl. per day); acid-layer-type petroleum sulfonate; detergent alkylate; sodium cresylate.

STAUFFER CHEMICAL CO., Louisville, Ky.
Raw material: Propane; propylene; natural gas.
Principal products: Carbon tetrachloride; perchlorethylene; chloroform; methylene chloride; hydrogen chloride.

STAUFFER CHEMICAL CO., Le Moyne, Ala.
Raw material: Natural gas.
Principal product: Carbon disulfide.

SUN OIL CO., Marcus Hook, Pa.
Raw material: Refinery streams.
Principal products: Petroleum sulfonates; naphthenic acids; propylene tetramer (dodecene); propylene trimer (nonene); benzene (1,360 bbl. per day); toluene (2,150 bbl. per day); xylene (1,290 bbl. per day mixed xylenes).

SUN OIL CO., Toledo.
Raw material: Refinery streams.
Principal products: Butylenes; propylene; hydrogen.

SUNTIDE REFINING CO., Corpus Christi, Tex.
Raw material: Propylene.
Principal product: Tetramer (150,000 bbl. per year).
Raw material: Naphtha.
Principal products: Benzene (310 bbl. per day); toluene (900 bbl. per day); xylene (800 bbl. per day); ortho-xylenes and heavy aromatics.
Construction: Completed third quarter, 1958, an ortho-xylene fractionation unit with a 1,500-bbl. per day capacity to separate o-xylene from p-xylene and m-xylene mix.

T

TENNESSEE EASTMAN CO., Div. of Eastman Kodak Co., Kingsport, Tenn.
Raw material: Ethanol; isobutyraldehyde; normal-butyraldehyde; isobutyl alcohol; 2-ethylhexyl alcohol; 2-ethyl isohexanol; polyethylene; neopentyl glycol; isopropyl alchol.
Principal products: Acetic and butyric acids and anhydrides; acetaldehyde; acetanilide; n-butyl acetate; crotonic acid; dibutyl phthalate; diethyl phthalate; di-2-ethylhexyl phthalate; di-2-ethylhexyl adipate; di-isobutyl adipate; di-2-ethylhexyl sebacate; di-isobutyl phthalate; ethyl acetate; isobutyl acetate; isopropyl acetate; triethyl phosphate; acetone; polymeric plasticizer; 2-ethyl hexoic acid; polyethylene color concentrates; polyethylene waxes.
Raw material: Acetic and butyric acids and anhydrides.
Principal products: Cellulose acetate and cellulose acetate butyrate.
Raw material: Cellulose esters.
Principal products: Cellulose acetate textile fibers; acetate and butyrate plastics; plasticizers.

TEXAS BUTADIENE & CHEMICAL CORP., Channelview, Tex.
Raw material: n-butane; isobutane; isopentane; natural gasoline.
Principal products: Alkylate; butene-2 concentrate; butene-1 concentrate; propylene concentrate.

TEXAS BUTADIENE & CHEMICAL CORP., Channelview, Tex.
Construction: Will complete January 1, 1959, facilities for propylene concentrate.

TEXAS CO., THE, Port Arthur, Tex.
Raw material: Refinery fractions.
Principal products: Naphthenic acid; oil-layer type of petroleum sulfonates; ethane-ethylene stream; propane-propylene mixture; 1-butene; 2-butene and mixtures; heavy hydrocarbons; olefin polymers; diisobutylene; rust inhibitors; gasoline additives; lubricating oil additives.

TEXAS EASTMAN CO., Div. of Eastman Kodak Co., Longview, Tex .

Raw material: Propane; natural gas.
Principal products: Ethanol; isobutyraldehyde; normal-butyraldehyde; isobutyl alcohol; isobutyronitrile; polyethylene (85,000,000 lb. per year); 2-ethylhexyl alcohol; 2-ethyl isohexanol; neopentyl glycol.

TIDEWATER OIL CO., Avon (Associated), Calif.
Raw material: Naphtha fraction.
Principal products: Mixed aromatics (1,200 bbl. per day).

TIDEWATER OIL CO., Delaware City, Del.
Raw material: Naphtha fraction.
Principal products: Mixed aromatics (20,000 bbl. per day).

U

UNION CARBIDE CHEMICALS CO., South Charleston, W. Va.
Raw material: Natural gas; refinery gases; crude oil; other petroleum fractions.
Principal products: Alcohols; esters; ketones; glycol-ethers; plasticizers such as dioctyl phthalate and others; glycols such as ethylene-, di-and-triethylene glycols and others; polyethylene plastic; synthetic lubricants; oxides (ethylene and propylene oxides and acetals; aldehydes; organic acids; anhydrides; nitrogen compounds such as acetonitrile, amines (mono, di, and triethanol amines, morpholine and other amines); chlorine compounds such as ethylene dichloride, ethylene and propylene chlorhydrin, etc.; aryl chemicals such as acetoacetanilide, 2-methyl-5-ethyl pyridine, etc.; surface-active agents (ionics and anionics).

UNION CARBIDE CHEMICALS CO., Institute, W. Va.
Raw material: Natural gas; other petroleum streams.
Principal products: Acetaldehyde; acetic acid; acetic anhydride; acetone; acetonitrile; acetophenone; acrolein; acrylonitrile; n-butyl alcohol; butyric acid; butyric anhydride; diethylene glycol; diisobutyl ketone; 2-ethylbutanol; ethylene glycol; ethylene oxide; 2-ethylhexanol; n-hexanol; isophorone; isopropanol; maleic anhydride; mesityl oxide; methyl acetone; 2-methyl-5-ethyl pyridine; methyl isobutyl ketone; paraldehyde; plasticizers; alpha-picoline; gamma-picoline; polyethylene glycols; propionic anhydride; trimethyl nonanone-4.

UNION CARBIDE CHEMICALS CO., Texas City, Tex.
Raw material: Natural gas; refinery gases (ethane, propane).
Principal products: Acetaldehyde; acetic acid; acetic anhydride; acetone; 2-aminoethyl ethanolamine; n-butyl acetate; n-butyl alcohol; diethylene glycol; diethylene triamine; ethanol; ethyl acetate; ethylene diamine; ethylene dichloride; ethylene glycol; ethylene oxide; isobutanol; isopropanol; isopropyl; acetate; methanol; methyl acetone; methyl isobutyl ketone; polyethylene; tetraethylene pentamine; trichlorethane; triethylene tetramine; vinyl acetate; vinyl chloride; other vinyl resins and vinyl plastic materials. (Acetylene made from natural gas and ethylene made from natural gas and/or refinery gases, ethane, propane are used internally.)
Construction: Building a second oxo unit to double oxo-chemicals capacity, with completion slated for mid-1959.

UNION CARBIDE CHEMICALS CO., Whiting, Ind.
Raw material: Refinery gases.
Principal products: Acetic anhydride; acetone; ethanol; ethylene oxide and ethylene glycol; isopropanol; methyl ethyl ketone; methyl isobutyl ketone.
Construction: Building a 72,000,000-lb. per year polyethylene plant.

UNION CARBIDE CHEMICALS CO., Torrance, Calif.
Raw material: Refinery cracked gases (ethylene).
Principal products: Polyethylene; ethylene oxide and ethylene glycol.

UNION CARBIDE CHEMICALS CO., Seadrift, Tex.
Raw material: Natural gas (ethane).
Principal products: Polyethylene; ethylene oxide and ethylene glycol.

UNION CARBIDE CHEMICALS CO., Niagara Falls, N. Y.
Raw material: Acetylene.
Principal products: Vinyl esters; acetic acid hydroxyethyl cellulose.

UNION CARBIDE CHEMICALS CO., Putnam, W. Va.
Construction: Plans have been deferred for the planned $50,000,000, 150,000,000-lb. per year ethylene and propylene plant which was initially slated for completion in 1960. Estimates indicate a construction delay of 2 to 3 years.

UNION CARBIDE CHEMICALS CO., Puerto Rico.
Construction: Building new ethylene oxide-glycol facilities.

UNION CARBIDE CORP., Bakelite Co. Div., Marietta, Ohio.
Raw material: Petroleum-derived stocks.
Principal products: Styrene plastics; phenol; epoxy resins.
Construction: Adding 15,000,000 lb. per year to epoxy plant by early 1959. (Bakelite now directs operation of seven polyethylene resin plants including Seadrift, Tex., using Phillips process—55,000,000 lb. per year, and Institute, W. Va., using Ziegler process—30,000,000 lb. per year.)

UNION OIL CO OF CALIFORNIA, Wilmington, Calif.
Raw material: Refinery gases and wastes.
Principal products: Methyl, ethyl mercaptans (500,000 lb. per year).

UNIVERSAL DETERGENTS, INC., Long Beach, Calif.
Raw material: Petroleum fractions.
Principal products: Alkyl naphthalene sulfonates; aromatic solvents.

U. S. INDUSTRIAL CHEMICALS CO. (subsidiary of National Distillers & Chemical Corp.), Tuscola, Ill.
Raw material: Butadiene.
Principal product: Dibasic acid (mixture of isomers of sebacic acid).

V

VELSICOL CHEMICAL CORP., Marshall, Ill.
Raw material: Petroleum base stocks.
Principal products: Benzene-1°; benzene motor grade; toluenes; xylenes; high-boiling aromatic petroleum solvents; petroleum derived formulation solvents; hydrocarbon polymers and resins.

VICKERS PETROLEUM CO., INC., Potwin, Kans.
Raw material: Catalytic reformate.
Principal products: Benzene (100 bbl. per day); toluene (400 bbl. per day); xylenes (400 bbl. per day); higher aromatics (300 bbl. per day).

VISCO PRODUCTS CO., INC., Sugarland, Tex.
Raw material: Petroleum fractions; petroleum chemicals.
Principal products: Crude oil desalting and dehydrating chemicals; special oxyalkylated compounds.

VISCO PRODUCTS CO., INC., Anaheim, Calif.
Raw material: Petroleum fractions; petroleum chemicals.
Principal products: Crude-oil desalting and dehydrating chemicals.

W

WITCO CHEMICAL CO., Chicago.
Raw material: Petroleum naphthenic acid.
Principal products: Metallic naphthenates (paint-drying agents and lube additives).
Raw material: Petroleum wax.
Principal products: Sun-checking inhibitors (rubber compounding).
Raw material: Asphalt fractions.
Principal products: Rubber extenders; saturating compounds; insulating mastics.

WITCO CHEMICAL CO., Perth Amboy, N. J.
Raw material: Solid petroleum tar; heavy liquid and semisolid petroleum fractions.
Principal products: Rubber extenders; extending plasticizer; rubber softeners; sun-checking inhibitors; insulating compounds.

WITCO CHEMICAL CO., Lawrenceville, Ill.
Raw material: Solid petroleum tar; heavy liquid and semisolid petroleum fractions.
Principal products: Rubber extenders; extending plasticizers; rubber softeners; sun-checking inhibitors; insulating compounds.

WITCO CHEMICAL CO., Los Angeles.
Raw material: Naphthenic acids.
Principal products: Metallic naphthenates.

WYANDOTTE CHEMICALS CORP., Michigan Alkali Div., Wyandotte, Mich.
Raw material: Petroleum fractions and derivatives.
Principal products: Alkyl aryl sulfonates; ethylene glycol; diethylene glycol; ethylene dichloride; propylene oxide; polypropylene glycol; polyoxyalkylene compounds; chloroethers; aromatic distillates and solvents (chlorinated solvents).

WYANDOTTE CHEMICALS CORP., Michigan Alkali Div., Geismar, La.
Raw material: Ethylene and oxygen.
Principal products: Ethylene oxide (60,000,000 lb. per year); ethylene glycol; diethylene glycol.
Construction: Will complete by end of 1958, a $26,000,000 electrolytic chlorine caustic plant.

2—NITROGEN-CHEMICAL MANUFACTURE, U. S.

A

ALLIED CHEMICAL CORP., Nitrogen Div., South Point, Ohio.
Raw material: Natural gas.
Principal products: Ammonia (725 tons per day); urea; nitrogen solutions; high-analysis mixed fertilizer; urea-formaldehyde concentrate.
Construction: Nitrogen capacity will be increased from 80,000 to 110,000 tons per year by late 1958.

ALLIED CHEMICAL CORP, Nitrogen Div., Hopewell, Va.
Raw material: Natural gas.
Principal products: Ammonia (935 tons per day); ammonium nitrate-limestone; pebbled ammonium nitrate; nitrogen solutions; sodium nitrate; nitrogen tetroxide.

ALLIED CHEMICAL CORP., Nitrogen Div., La Platte, Neb.
Raw material: Natural gas.
Principal products: Ammonia (210 tons per day); urea (110,000 tons per year); nitrogen solutions.

AMERICAN CYANAMID CO., Fortier Plant, Avondale, La.
Raw material: Natural gas.
Principal products: Ammonia (300 tons per day); ammonium sulfate.

APACHE POWDER CO., Curtis, Ariz.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (30 tons per day).

ATLANTIC REFINING CO., Philadelphia.
Raw material: Byproduct hydrogen from catalytic reformer.
Principal product: Ammonia (165 tons per day).

C

CALIFORNIA-SPRAY CHEMICAL CORP. (Subsidiary of California Chemical Co.), Richmond, Calif.
Raw material: Natural and refinery gases.
Principal products: Ammonia (300 tons per day); nitric acid (250 tons per day); ammonium sulfate; ammonium nitrate; fertilizer solutions.

CALUMET NITROGEN PRODUCTS CO., (Standard Oil Co., Ind. and Sinclair Refining Co.) Hammond, Ind.
Raw material: Hydrogen rich refinery gas.
Principal products: Anhydrous ammonia and solutions (300 tons per day).

COLLIER CARBON AND CHEMICAL CORP. (formerly Brea Chemicals, Inc.), Brea, Calif.
Raw material: Natural gas.
Principal products: Ammonia (300 tons per day); dry ice and liquid CO_2 (100 tons per day); ammonium nitrate; ammonium phosphate.

COMMERCIAL SOLVENTS CORP., Sterlington, La.
Raw material: Natural gas.
Principal products: Ammonia (400 tons per day); ammonium nitrate; nitrogen solutions.

COOPERATIVE FARM CHEMICALS ASSOCIATION, Lawrence, Kans.
Raw material: Natural gas.
Principal products: Ammonia (180 tons per day); ammonium nitrate and nitrogen solutions.
Construction: Will start fall 1958 and complete fall 1959, facilities to increase ammonia production from 180 to 270 tons per day.

D

DEERE & CO., Grand River Chemical Div., Pryor, Okla.
Raw material: Natural gas.
Principal products: Ammonia (180 tons per day); urea (90,000 tons per year); nitrogen solutions.
Construction: Will complete fourth quarter 1958, a plant to recover 10 to 15 additional tons per day of ammonia.

DU PONT, E. I. DE NEMOURS & CO., Belle, W. Va.
Raw material: Natural gas.
Principal product: Urea (150,000 tons per year). Converting ammonia synthesis from coke over gas to natural gas.

DU PONT, E. I., DE NEMOURS & CO., Gibbstown, N. J.
Construction: Revising operations to make hydrogen by reforming natural gas; building new anhydrous ammonia units (ammonia is captive).

E

ESCAMBIA CHEMICAL CORP., Pensacola, Fla.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day); ammonium nitrate; nitrogen fertilizer solutions.

G

GENERAL PETROLEUM CORP., Torrance, Calif.
Raw material: Refinery streams.
Principal product: Ammonium sulfate.

GONZALEZ CHEMICAL INDUSTRIES, INC., Guanica, P. R.
Raw material: Selected crude oil.
Principal products: Anhydrous ammonia (42,000 long tons per year); ammonium sulfate (140,000 tons per year).

GRACE, W. R., & CO., (Grace Chemical Div.), Woodstock, Tenn.
Raw material: Natural gas.
Principal product: Ammonia (250 tons per day); urea (55,000 tons per year).
Construction: Plans to expand capacity of urea facilities to 75,000 tons per year.

H

HERCULES POWDER CO., Hercules, Calif.
Raw material: Natural gas.
Principal products: Ammonia (150 tons per day).
Construction: Will complete fall 1958, facilities for 20,000 tons per year of synthetic urea..

HERCULES POWDER CO., Louisiana, Mo.
Raw material: Natural gas.
Principal products: Ammonia (115 tons per day).

M

MISSISSIPPI CHEMICAL CORP., Yazoo City, Miss.
Raw material: Natural gas.
Principal products: Ammonia (280 tons per day); ammonium nitrate; nitric acid (150 tons per day).
Construction: Will complete late September 1958, a 30-ton per day expansion of anyhydrous ammonia.

MISSISSIPPI RIVER CHEMICAL CO., Crystal City, Mo.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day); nitric acid (240 tons per day); ammonium nitrate (200 tons per day); ammonia solutions.

MONSANTO CHEMICAL CO., Inorganic Chemicals Div., El Dorado, Ark.
Raw material: Natural gas.
Principal products: Ammonia (585 tons per day); ammonium nitrate; ammonium sulfate; nitrogen solutions; aqua ammonia; urea (100 tons per day).

MONSANTO CHEMICAL CO., Inorganic Chemicals Div., Luling, La.
Raw material: Natural gas.
Principal products: Ammonia (400 tons per day); ammonium nitrate; solid (dry ice) and liquid CO_2 (42 tons per day).

N

NORTHERN CHEMICALS INDUSTRIES, Searsport, Me.
Raw material: Bunker C fuel oil.
Principal products: Ammonia (125 tons per day); nitrogen solutions.

O

OLIN MATHIESON CHEMICAL CORP., Lake Charles, La.
Raw material: Natural gas.
Principal products: Ammonia (250 tons per day); hydrazine.

P

PETROLEUM CHEMICALS, INC., (Cities Service Co. and Continental Oil Co.), Lake Charles, La.
Raw material: Petroleum feed stocks.
Principal products: Ammonia (100,000 tons per year); oxygen (90 tons per day).

PHILLIPS CHEMICAL CO., Pasadena, Tex.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (191,600 short tons per year).
Raw material: Ammonia and sulfuric acid.
Principal product: Ammonium sulfate (401,500 short tons per year).

PHILLIPS CHEMICAL CO., Etter, Tex.
(Anhydrous ammonia and nitric acid facilities are government leased).
Raw material: Natural gas.
Principal product: Anhydrous ammonia (191,600 short tons per year).
Raw material: Ammonia.
Principal product: Nitric acid (130,000 short tons per year).
Raw material: Ammonia and nitric acid.
Principal product: Ammonium nitrate (142,000 short tons per year).
Raw material: Ammonia and ammonium nitrate.
Principal product: Nitrogen solutions (55,000 short tons per year).

PHILLIPS PACIFIC CHEMICAL CO. (Phillips Petroleum Co. and Pacific Northwest Pipeline Corp.) operated by Phillips Chemical Co., Kennewick, Wash.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (73,000 short tons per year).

R

ROHM & HASS CO., Pasadena (Deer Park), Tex.
Raw material: Natural gas.
Principal product: Ammonia.

S

SAN JACINTO CHEMICAL CO., Div. of Smith-Douglass Co., Inc., Houston,
Raw material: Natural gas.
Principal product: Anhydrous ammonia (40,000 tons per year).

SHELL CHEMICAL CORP., Ventura, Calif.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day); urea (100 tons per day).

SHELL CHEMICAL CORP., Shell Point (Pittsburg), Calif.
Raw material: Natural gas.
Principal products: Ammonia (100,000 tons per year); ammonium sulfate; diammonium phosphate; catalysts.

SOUTHERN NITROGEN CO., INC., Savannah, Ga.
Raw material: Natural gas.
Principal products: Anhydrous ammonia (275 tons per day); nitrogen solutions; prilled ammonium nitrate; urea (10,000 tons per year).

SPENCER CHEMICAL CO., Calumet City, Ill.
Raw material: Methanol and ammonia.
Principal product: Aqua ammonia.

SPENCER CHEMICAL CO., Pittsburg, Kans.
Raw material: Natural gas (hydrogen and carbon monoxide).
Principal products: Ammonia (200 tons per day); nitric acid; aqua ammonia; ammoniating solutions; ammonium nitrate; dry ice.

SPENCER CHEMICAL CO., Henderson, Ky.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day); nitric acid; ammonia solutions; urea (100 tons per day); aqua ammonia.

SPENCER CHEMICAL CO., Vicksburg, Miss.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day); nitric acid; ammonia solutions; urea (11,000 tons per year).

SPENCER CHEMICAL CO., Fort Worth, Tex.
Raw material: Natural gas.
Principal products: Dry ice and liquid CO_2.

STANDARD OIL CO. OF CALIFORNIA, Richmond, Calif.
Raw material: Natural gas.
Principal products: Ammonia; nitric acid.

STANDARD OIL CO. (Ohio), Lima, Ohio.
(Manufacturer is Sohio Petroleum Co., a subsidiary).
Raw material: Natural gas; refinery offgas.
Principal products: Anhydrous ammonia (300 tons per day); nitric acid; urea (44,000 tons per year); carbon dioxide (liquid and solid); ammonium nitrate; nitrogen solutions.

ST. PAUL AMMONIA PRODUCTS, INC., Pine Bend Plant, South St. Paul, Minn.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day); ammonium nitrate solutions.

SUN OIL CO., Marcus Hook, Pa.
Raw material: Hydrogen from cat reformer.
Principal product: Ammonia (300 tons per day).

SUN OIL CO. and **OLIN MATHIESON CHEMICAL CORP.,** Marcus Hook, Pa.
Construction: Have tentative plans for a 73,000-ton per year urea plant. A new company will be formed to operate the plant. Completion is slated for early 1960.

T

TENNESSEE VALLEY AUTHORITY, Wilson Dam, Ala.
(Noncommercial plant owned and operated by the Government).
Raw material: Natural Gas.
Principal product: Ammonia (250 tons per day).

TEXAS CITY CHEMICALS CO., INC. (subsidiary of Smith-Douglas Co., Inc.), Texas City, Tex.
(Facilities formerly operated by San Jacinto Chemical Co. have been moved to Texas City).
Raw material: Natural gas.
Principal product: High-analysis fertilizers (20,000 tons per year).

TEXAS CO., THE, Lockport, Ill.
Raw material: Natural gas.
Principal products: Anhydrous ammonia (80 tons per day of refrigeration, commercial, and agricultural grades); aqua ammonia (industrial and agricultural grades); nitrogen solutions (industrial and agricultural grades).

U

UNION OIL CO. OF CALIFORNIA, Wilmington, Calif.
Raw material: Refinery gases and wastes.
Principal products: Ammonium sulfate (20,000 tons per year).

U. S. INDUSTRIAL CHEMICALS CO. (subsidiary of National Distillers & Chemical Corp.), Tuscola, Ill.
Raw material: Natural gas.
Principal products: Ammonia (165 tons per day); ammonium nitrate.

OTHER AMMONIA PLANTS

(Hydrogen from coke-oven and coke water gas).
Ketona Chemical Co. (Hercules and Alabama Byproducts), Keona Ala.., 125 tons per day.
U. S. Steel, Geneva, Utah, 200 tons per day.

(Hydrogen from chlorine cells).
Columbia-Southern Chemical Co., Natrium, W. Va., 75 tons per day.
Dow Chemical Co., Pittsburg, Calif., 20 tons per day; Freeport, Tex., 230 tons per day; Midland, Mich., 100 tons per day.
Du Pont, E. I., de Nemours & Co., Niagara Falls, N. Y., 30 tons per day.
Food Machinery and Chemicals Corp., Westvaco Chlor-Alkali Div., Charleston, W. Va., 60 tons per day.
Hooker Chemicals Corp. (formerly Hooker Electrochemical Co.), Tacoma, Wash., 60 tons per day.
Olin Mathieson Chemical Corp., Lake Charles, La., 60 tons per day; Niagara Falls, N. Y., 20 tons per day.
Pensalt Chemicals Corp., Wyandotte, Mich., 95 tons per day; Portland, Ore., 20 tons per day.

3—BUTADIENE AND COPOLYMER, U. S.

(Companies making N-type rubbers and other elastomers are listed in 1-Organics).

COPOLYMER (SBR)
(Formerly GR-S)

AMERICAN SYNTHETIC RUBBER CORP., Louisville, Ky., 68,500 long tons per year.

COPOLYMER RUBBER & CHEMICAL Corp., Baton Rouge, La., 68,800 long tons per year.
Construction: Will complete November 1, 1958. black masterbatch facilities with capacity of 30,000 long tons per year, and additional finishing line, at a cost of $1,650,000.

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber & Latex, Div., Akron, Ohio, 40,000 long tons per year.

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber & Latex Div., Lake Charles, La., 190,000 long tons per year.

GENERAL RUBBER SYNTHETICS CORP., General Tire & Rubber Co., Odessa, Tex., 40,000 long tons per year (cold SBR, oil extended; black masterbatch and combinations).

GOODRICH-GULF CHEMICALS, INC., Port Neches, Tex., 90,000 long tons per year.
Construction: Capacity is being expanded by phases as adjoining butadiene plant is expanded. Will complete before the end of 1958, facilities for black masterbach rubbers at a cost of $1,000,000.

GOODRICH-GULF CHEMICALS INC., Institute, W. Va., 122,000 long tons per year.
Construction: A 4-year expansion and modernization program, including a $1,000,000 expansion of crumb-rubber facilities, is under way with completion slated for late 1958.

GOODYEAR TIRE & RUBBER CO., Akron, Ohio, 15,200 long tons per year.

GOODYEAR TIRE & RUBBER CO., Houston, 220,000 long tons per year.

LUMMUS

ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

385 Madison Avenue New York 17, N. Y.

Lummus Designing and Engineering Gas Conservation Plant on Lake Maracaibo for Compania Shell de Venezuela

New Plant to Play Important Role in Crude Production Program and Gas Conservation

Artist's conception

The Lummus Company is designing a 200 million cubic foot/day gas conservation plant for Compania Shell de Venezuela on Lake Maracaibo near Laguinallas.

The new plant will reinject, at high pressures, gases which have been released during the production of crude.

The gas will be conducted from the gathering stations through a network of large pipelines, as large as 30" diameter, laid on the bottom of the lake to the reinjection plant. There, using local gas as fuel, the gas is compressed by 7 gas turbine driven compressors, having a total of 56,000 HP. The high pressure gas is then returned to the oil field by pipelines on the bottom of the lake.

The plant will be constructed on a 150' x 250' platform 15 feet above the lake level, supported by approximately 250 reinforced concrete piles. The plant's tropical architecture will conform to the styling of the locale and will include modern lockers, change rooms and canteen.

Lummus is employing the most modern techniques in automatic controls and safety practices in the plant plans. Special efforts are being made to soundproof and air condition the control rooms and operating offices to afford optimum working conditions. Modern safety techniques are being used to detect gas leaks anywhere on the platform to insure overall safety for operating personnel.

Lummus has over 50 years experience in the design and construction of more than 800 plants for the process industries throughout the world. If you have a project in mind, we will be glad to discuss it with you.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y., Houston, Chicago, Washington, D. C., Montreal, London, Paris, The Hague, Caracas, Maracaibo. *Engineering Development Center:* Newark, N. J.

Sold on past performance, Penrod powers its third drilling rig with CAT Diesel Engines

Penrod Drilling Co. of Shreveport, La., working Rig No. 45, fifty miles southwest of Houma in Cat Island Pass (on the southwest edge of Kye Island field) relies on Cat Diesel Engines in drilling better than 1,000 ft. per day. With four D397s, two D315s and two D342s, the "Jim Garrison" barge moved in on Sept. 14, spudded a 15" surface hole and set 3,029 ft. of 10¾" surface pipe. On Oct. 31, they were out of the hole to run electric log at 15,177 ft. and cut a 9⅞" hole on the first well. Their best drilling time was 10,026 ft. in 10 days from spudding date. More than 1,000 ft. per day.

On this offshore drilling operation, Penrod compounds three of its Caterpillar D397 Diesel Engines to drive the Emsco drawworks. Two D315s and a D397 drive water and mud pumps, and two Cat D342 Electric Sets handle auxiliary power.

A big operator and investor in dependable equipment, Penrod can't afford to guess about drilling power. This Company *knows* from experience that Cat Engines are reliably rated and are available in a variety of power sizes for any drilling assignment.

Only two of the many "guts" features which make Cat Engines the best for drilling are cylinder liners and pistons. To give long periods between overhauls, Cat Engine pistons are balanced to close tolerances. Cast-iron bands support the top rings for extra strength, and rings are chrome-faced for

Penrod Drilling Company's "Jim Garrison" Barge, powered by eight Cat Diesel Engines, has drilled at an average rate of 1,000 ft. a day on this job south of Houma, La.

longer wear. Piston rings ride freely with minimum wear because Cat cylinder liners are honed and chemically treated to give long life. Cat wet-type cylinder liners maintain low piston temperatures and are easily changed if necessary.

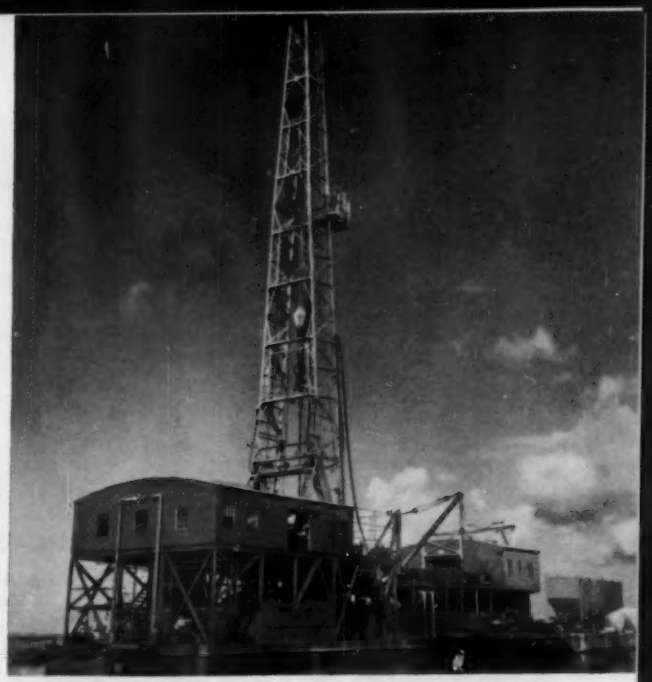
For drilling power—from prime to auxiliary—call your Caterpillar Dealer today. He's that real good neighbor—the one who knows what he's talking about. And be sure to specify Caterpillar power for your drilling equipment.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

DURABLE VALVES FOR LONG LIFE

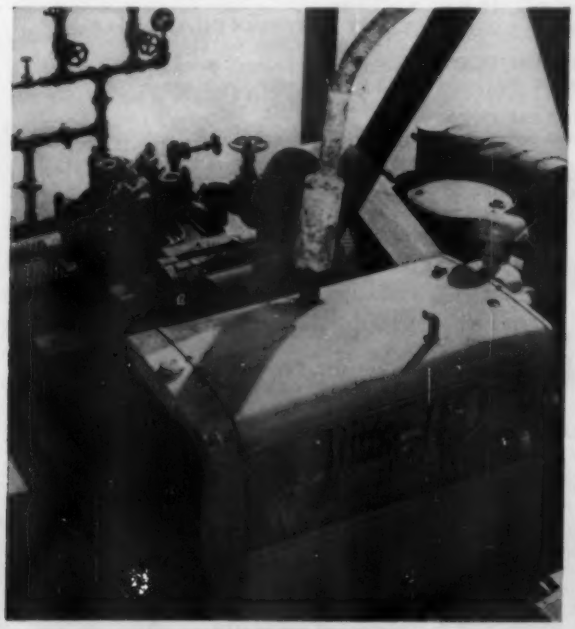
The Cat Engine's valve train features dual valve springs; sodium-filled, alloy steel valves; replaceable valve seats and guides; hardened cam followers; and valve rotators.

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

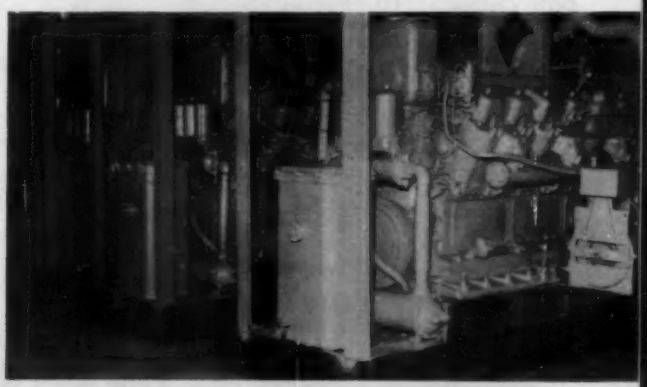


Penrod's Rig No. 41, drilling southeast of Port Sulphur, La., also is powered by Caterpillar. Two D397s are compounded to drive the drawworks, two additional D397s drive the mud pumps, two D315s drive Mission Water pumps, and a third D315 drives a Gardner-Denver water pump, with a Cat D315 Electric Set used for auxiliary power.

ENGINE POWER BY CATERPILLAR



This Caterpillar D315 Engine drives a water pump on Penrod's Rig No. 41 near Port Sulphur, La. One of many components which make Cat Engines dependable is aluminum precision-type bearings supporting the crankshaft. Each bearing has a thin coating of tin for proper bearing break-in for long engine life.



These three Cat D397 Engines are compounded to drive the Emsco drawworks on Penrod's Rig No. 45. Three additional Cat Engines drive the mud pumps and two Caterpillar Diesel Electric Sets furnish auxiliary power for the rig.

Dept. OG9, Engine Division
CATERPILLAR TRACTOR CO., Peoria, Illinois, U.S.A.
Send me more information about Caterpillar Diesel Engines for prime and auxiliary power in drilling operations.

☐ I would like detailed information, as I may be in the market for a Cat Diesel Engine or Electric Set. I understand I am under no obligation.

☐ I am interested in learning more in general about these engines.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

NAUGATUCK CHEMICAL, Div. of United States Rubber Co., Naugatuck, Conn., 30,000 long tons per year.

PHILLIPS CHEMICAL CO., Borger, Tex., 108,000 long tons per year.

SHELL CHEMICAL CORP., Torrance, Calif., 110,000 long tons per year.

TEXAS-U. S. CHEMICAL CO., Port Neches, Tex., 127,000 long tons per year.
Construction: Expanding capacity stepwise. Recently completed facilities for carbon-black masterbatch.

UNITED CARBON CO., INC., Baytown, Tex., 50,000 long tons per year.

BUTYL RUBBER (IIR)
(Formerly GR-I)

ESSO STANDARD OIL CO., Baton Rouge, La., 47,000 long tons per year.

HUMBLE OIL & REFINING CO., Baytown, Tex., 57,500 long tons per year.

PETROLEUM CHEMICALS, INC. (Cities Service Co. and Continental Oil Co.), Lake Charles, La.
Construction: Considering a $17,000,000, 30,000-ton per year butyl rubber plant.

BUTADIENE—PETROLEUM DERIVED

ALLIED CHEMICAL CORP., Tonawanda, N. Y., estimated 4,000 short tons per year (ethylene cracking byproduct).

COPOLYMER RUBBER & CHEMICAL CORP., Baton Rouge, La., 35,000 short tons per year.

DOW CHEMICAL CO., Midland, Mich., and Freeport, Tex., with combined capacity of 17,400 short tons per year (butadiene is ethylene cracking byproduct).

DOW CHEMICAL CO., Bay City, Mich.
Construction: Will complete in 1959, facilities to produce butadiene from refinery streams in conjunction with ethylene manufacture.

ESSO STANDARD OIL CO., Baton Rouge, La., 50,000 short tons per year (butadiene is ethylene cracking byproduct).

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber & Latex Div., Orange, Tex., 40,000 short tons per year.
Construction: Has delayed until 1959, planned expansion of butadiene 20,000 tons.

HUMBLE OIL & REFINING CO., Baytown, Tex., 65,000 short tons per year. (Shut down indefinitely).

NECHES BUTANE PRODUCTS CO. (Goodrich-Gulf Chemicals Co. and Texas-U. S. Chemical Co.), Port Neches, Tex., expansion from 220,000 to 300,000 short tons per year completed mid-1958.

ODESSA BUTADIENE CO., Odessa, Tex., 50,000 short tons per year.

PETROLEUM CHEMICALS, INC. (Cities Service Co. and Continental Oil Co.), Lake Charles, La., 80,000 short tons per year.

PETRO-TEX CHEMICAL CORP., Houston, 200,000 short tons per year.

PHILLIPS CHEMICAL CORP., Borger, Tex., 112,000 short tons per year.

SHELL CHEMICAL CORP., Torrance, Calif., 70,000 short tons per year.

STANDARD OIL CO. OF CALIFORNIA, El Segundo, Calif., (butadiene-butylene mixtures) 16,000 short tons per year butadiene; 1,870 bbl. per day butylene.

TEXAS BUTADIENE & CHEMICAL CORP., Houston, 65,000 short tons per year (can be increased to 85,000 depending on amount of alkylate and aviation gasoline also made at this plant).

UNION CARBIDE CHEMICALS CO., South Charleston, W. Va., Texas City, Tex., and Seadrift, Tex., with combined capacity of 35,000 short tons per year (butadiene is ethylene cracking byproduct).

4—SULFUR CONVERSION, U. S.

FROM SOUR NATURAL GAS

COLUMBIAN CARBON CO., Seminole, Tex., 15.4 tons per day.

GULF OIL CORP., Crane County, Tex., 20 tons per day.

FOOD MACHINERY & CHEMICALS CORP., Westvaco Chlor-Alkali Div., South Charleston, W. Va.

JEFFERSON LAKE SULPHUR CO., Manderson, Wyo., 50 tons per day.

MONSANTO CHEMICAL CO., Lion Oil Div., Magnolia, Ark, 10-12 tons per day.

OLIN MATHIESON CHEMICAL CORP., McKamie, Ark., 100 tons per day.

PAN AMERICAN PETROLEUM CORP., Midland Farms, Tex., 11 tons per day.

PAN AMERICAN PETROLEUM CORP., Odessa (North Cowden), Tex., 17 tons per day.

PAN AMERICAN PETROLEUM CORP., Sundown, Tex., 42 tons per day.

PAN AMERICAN PETROLEUM CORP., Elk Basin, Wyo., 100 tons per day.

PAN AMERICAN PETROLEUM CORP., Worland, Wyo., 20 tons per day.

PARKER, J. L., Madill, Okla., 15 tons per day.

PARKER, J. L. Penwell, Tex., 15 tons per day.

PHILLIPS CHEMICAL CO., Goldsmith and Crane, Tex., two plants with completed capacity of 73,000 long tons per year.

RICHARDSON, SID, GASOLINE CO., Kermit, Tex., 10 tons per day.

RICHARDSON, SID, GASOLINE CO., Odessa, Tex., 20 tons per day.

SHAMROCK OIL & GAS CORP., Sunray, Tex., 30 long tons per day, representing total capacity from both sour natural gas and refinery gas.

SIGNAL OIL CO., Tioga, N. D., 50 tons per day.

TEXACO-SEABOARD OIL CO. (subsidiary of The Texas Co.), Silver Tip Field, Wyo., 50 long tons per day.

TEXAS GULF SULPHUR CO., Worland, Wyo., 300 tons per day.

WARREN PETROLEUM CO., Waddel, Tex., 50 tons per day.

WARREN PETROLEUM CO., Monument, N. M., 18 tons per day (shut down).

FROM REFINERY GAS

ALLIED CHEMICAL CORP., General Chemical Div., Bayonne, N. J., 30 tons per day.

AMERICAN OIL CO., Yorktown, Va., 50 tons per day.

ATLANTIC REFINING CO., Philadelphia (refinery gas to sulfuric acid.)

EL PASO NATURAL GAS CO., operator, Eunice, N. M., 30 tons per day.

FREEPORT SULPHUR CO., Westville, N. J., 30 tons per day.

GREAT NORTHERN OIL CO., Pine Bend, Minn., 50 tons per day.

GULF OIL CORP., Port Arthur, Tex., 120 tons per day.

GULF OIL CORP., Philadelphia, Pa., 130 tons per day.

HANCOCK CHEMICAL CO., Watson, Calif., 200 tons per day.

HANCOCK OIL CO., Signal Hill, Calif., 10 tons per day.

MONTANA SULPHUR & CHEMICAL CO., Billings, Mont., 40 tons per day.

PURE OIL CO., Lemont, Ill., 20 tons per day.

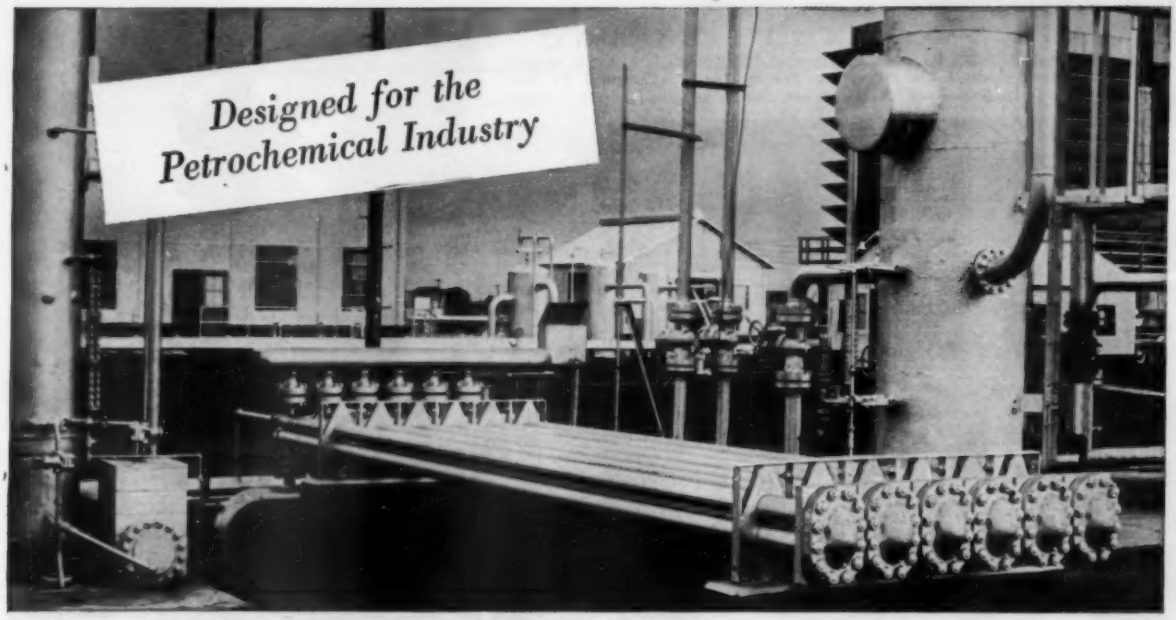
SHAMROCK OIL & GAS CORP., Sunray, Tex., 30 tons per day, representing total capacity from both sour natural gas and refinery gas; (also listed under "Sour Natural Gas."

SHELL CHEMICAL CORP., Houston.

SINCLAIR REFINING CO., Houston, 30 tons per day.

SINCLAIR REFINING CO., Marcus Hook, Pa.

SOCONY MOBIL OIL CO., INC., Paulsboro, N. J., 80 tons per day.



G-R Twin G-Fins...versatile and simple

Griscom-Russell Twin G-Fin Sections are the simplest type of heat exchanger—therefore, they're the easiest to maintain and use.

Their simple construction—a finned tube within another tube—makes their operation foolproof and simplifies repair and cleaning when necessary.

Individual Twin G-Fin Units can be connected in series or parallel in any number required for use as gas or fluid heaters and coolers, reboilers, condensers, and vapor and liquid heat exchangers. Capacity can be easily added or removed and the units can be reused in different services and locations easily.

Send for Griscom-Russell Bulletin 1401R

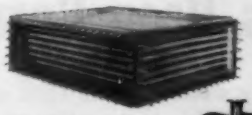
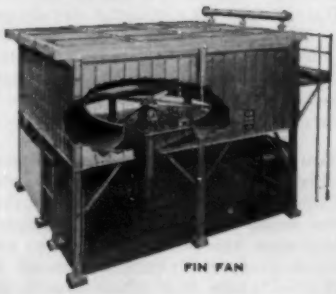


PLATE FIN EXCHANGER

REBOILER

CONDENSER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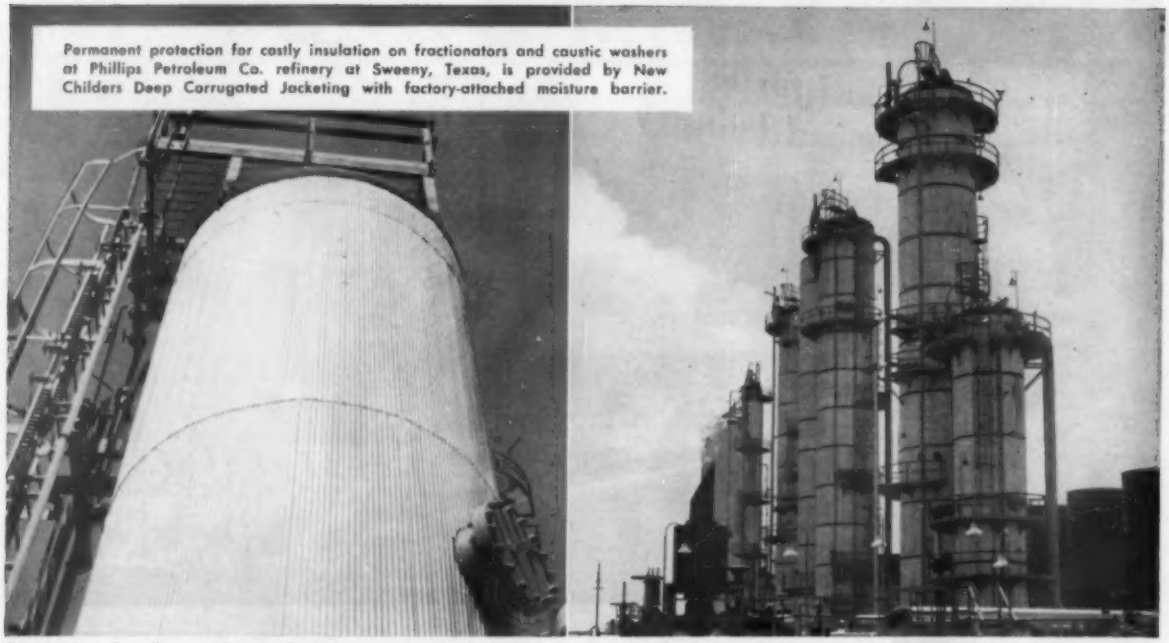


Permanent protection for costly insulation on fractionators and caustic washers at Phillips Petroleum Co. refinery at Sweeny, Texas, is provided by New Childers Deep Corrugated Jacketing with factory-attached moisture barrier.

Protection for the costly insulation on this caustic washer was applied in one easy operation because Childers Jacketing has factory-attached moisture barrier.

These gleaming aluminum-covered towers will always look new! No need to paint Childers Jacketing . . . a savings that alone may pay full cost of jacketing *plus* installation!

Why 724 plants specified this . . .

New Kind of Protection for Towers, Vessels & Tanks . . . Childers Deep Corrugated Aluminum Jacketing:

Read why exclusive benefits of factory-attached moisture barrier are fast making Childers Jacketing the standard of the industry.

Only Childers gives you this special feature: Factory-Attached Moisture Barrier that (1) eliminates any danger of harm to the underneath side of the jacketing. And, (2) saves you time, labor and money because you apply jacketing with moisture barrier already attached . . . in one single operation.

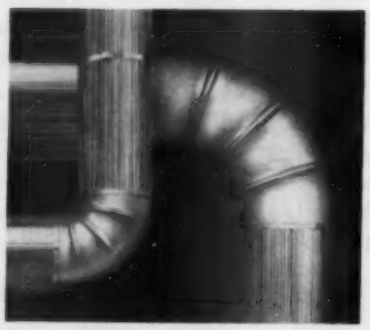
You also get greater strength and greater protection at less cost with Childers Cross-Crimp®. Tests prove the rolled-in 3/16" cross corrugation increases the vertical strength and rigidity of .019" thick aluminum to that of plain .032" thick aluminum. Jacketing costs are consequently reduced as much as ⅓ when Childers Jacketing is used instead of ordinary sheet aluminum.

It's easy to install. Childers Deep Corrugated Jacketing. Jacketing is applied with sheet metal screws used on both the vertical and circumferential lap. Screws may be omitted from circumferential lap when necessary to provide expansion joints.

Comes in two corrugations: 1¼" and 2½"; and four thicknesses: .016", .019", .020" and .024". The .019" and .024" thicknesses are made from roofing alloy for maximum life—recommended for normal jacketing of towers, vessels, and tanks. The .016" and .020" thicknesses are available in #3003-H-14 alloy.

For a free sample of Childers Deep Corrugated Aluminum Jacketing with factory-attached moisture barrier, plus engineering data on how to safeguard your insulation, write to Childers Manufacturing Company, Dept. OGJ-1, P.O. Box 7467, Houston 8, Texas.

In Canada, write direct to Peerless Mfg. Co., Sub-Post Office 28, Calgary, Alberta.



For insulated lines Childers Aluminum Weather-Proof Jacketing in rolls goes on about 30% faster than ordinary weatherproofing, fits perfectly, never needs painting. Used with Childers exclusive 90° and 45° Ell-Jacs, this modern aluminum protection gives your insulated lines that well-dressed look from end to end.

Only Childers makes available to you complete specifications and engineering data on aluminum jacketing in these catalogs: Refinery Catalog pp. 341-4; Sweet's Industrial Construction File pp. 6b/Ch; Chemical Engineering Catalog pp. 530a-d.

STANDARD OIL CO. (Ind.), Whiting, Ind., 62 short tons per day.

STAUFFER CHEMICAL CO., Dominguez, Calif., (sulfuric acid from refinery sludge acid—includes facilities for recovery of sulfur from H_2S).

STAUFFER CHEMICAL CO., Consolidated Chemical Industries Div., Baton Rouge, La. (Refinery sludge acid and sulfur to sulfuric acid and including facilities for sulfur manufacture from refinery H_2S gas stream).

STAUFFER CHEMICAL CO., Consolidated Chemical Industries Div., Baytown, Tex., over 100 tons per day.

SUN OIL CO., Marcus Hook, Pa.

TEXAS CO., THE, Los Angeles, Calif.

TIDEWATER OIL CO., Delaware City, Del., 300 tons per day.

UNION OIL CO. OF CALIFORNIA, Wilmington, Calif., 14,000 tons per year.

UNION OIL CO. OF CALIFORNIA, Santa Maria, Calif., two plants with combined capacity of 15,000 tons per year.

UNION OIL CO. OF CALIFORNIA, Oleum, Calif., 18,250 tons per year.

WILSHIRE OIL CO. OF CALIFORNIA (Pontiac Western Corp.), Norwalk, Calif., 20 tons per day.

5—CARBON BLACK, U. S.

FURNACE PROCESS

CABOT CARBON CO., Ville Platte, La.; Franklin, La.; Pampa, Tex.; Big Spring, Tex.. (Combined gas throughput 48,000,000 cu. ft. per day; oil throughput 4,000 bbl. per day).

COLUMBIAN CARBON CO., Conroe, Tex.; Seagraves, Tex.; Eola, La.; Hickok, Kans.; North Bend, La.; El Dorado, Ark.

CONTINENTAL CARBON CO., Ponca City, Okla.; Lake Charles, La.; Eunice, N. M.; Sunray, Tex.

HUBER, J. M., CORP., Baytown, Tex. (110 tons per day); Borger, Tex. (90 tons per day).

PHILLIPS CHEMICAL CO., Borger, Tex. (290,000,000 lb. per year).

SHELL CHEMICAL CORP., Shell Point, Calif.

THERMATOMIC CARBON CO., Div. of Commercial Solvents Corp., Sterlington, La.

UNITED CARBON CO., Aransas Pass, Tex.; Shamrock, Tex.; Ryus, Kans.; Ivanhoe, La.

CHANNEL PROCESS

CABOT CARBON CO., Skellytown, Tex.; Kermit, Tex. (Combined gas throughput 60,000,000 cu. ft. per day).

COLTEXO CORP., Lefors, Tex. (32,000,000 cu. ft. per day gas throughput).

COLUMBIAN CARBON CO., Lefors, Tex.; Sweeny, Tex.; Eunice, N. M.; Coltexo, Tex.; Seagraves, Tex.

HUBER, J. M., CORP., Borger, Tex. (74 tons per day).

RICHARDSON, SID, CARBON CO., Odessa, Tex. (75,000,000 lb. per year).

UNITED CARBON CO., Aransas Pass., Tex. (20,000,000 cu. ft. per day throughput); Bayville, La. (1,600 lb. per day); Falfurrias, Tex. (24,000 lb. per day); Eunice, N. M. (96,000 lb. per day).

ROLLER PROCESS

CARBON BLACKS, INC., Rayville, La. (high-grade color blacks only — 120,000 lb. per year).

COLUMBIAN CARBON CO., Peerless Carbon Black Div., Sweeny Tex. (5,000,000 cu. ft. per day throughput); Gray County, Texas (12,000,000 cu. ft. per day throughput).

6—CANADIAN PLANTS

B-A SHAWINIGAN, LTD. (British American Oil Co., and Shawinigan Chemical), Montreal, Que.
Raw material: Cumene.
Principal products: Phenol (over 25,000,000 lb. per year); acetone (over 15,000,000 lb. per year); isopropanol; methyl styrene, nonyl phenol.

BRITISH AMERICAN OIL CO., LTD., Montreal, Que.
Raw material: Propylene; benzene.
Principal produet: Cumene.

BRITISH AMERICAN OIL CO., LTD., Pincher Creek, Alta.
Raw material: Fuel-gas streams.
Principal product: Sulfur (225 tons per day).
Construction: Plant will be expanded stepwise.

CABOT CARBON CO. OF CANADA, LTD Sarnia, Ont.
Raw material: Petroleum fractions.
Principal product: Oil-type furnace black (over 55,000,000 lb. per year).

CANADIAN CHEMICAL CO., LTD. (subsidiary of Celanese Chemical Corp.), Edmonton, Alta.
Raw material: Butane; propane.
Principal products: Pentaerythritol (8,500 tons per year); methanol; propylene glycol; dipropylene glycol; n-propanol; n-propyl acetate; acetic acid; acetone; other alcohols, glycols, aldehydes, oxides, ketones, and cellulose acetates. (Cellulose acetates capacity is 12,500 tons per year).

CANADIAN INDUSTRIES, LTD., Edmonton, Alta.
Raw material: Natural gas, from which ethane is obtained.
Principal product: Polyethylene (22,000,000 lb. per year).
Construction: Will complete summer 1959, an increase in polyethylene capacity from 22,000,000 lb. to 40,000,000 lb. per year.

CANADIAN INDUSTRIES, LTD., Millhaven, Ont.
Raw material: Ethylene glycol; dimethylester of terephthalic acid.
Principal products: Synthetic polyester fiber and flake.
Raw material: "Bunker C" fuel oil.
Principal product: Anhydrous ammonia (200 tons per day).

CANADIAN OIL COMPANIES, LTD., Sarnia Plant, Corunna, Ont.
Raw material: Refinery streams.
Principal products: Benzene; toluene xylene; aromatic solvents; paraffinic solvents; hydrogen; methane; ethane; ethylene; propane-propene; butane-butene.

CARBIDE CHEMICALS CO., (Div. of Union Carbide Canada, Ltd.), Montreal East, Que.
Raw material: Refinery gases.
Principal products: Ethylene (captive); ethylene oxide; ethylene glycols; polyethylene glycols; glycol ethers; ethanolamines; polyethylene.
Construction: Will increase polyethylene to 40,000,000 lb. per year and ethylene glycol to 50,000,000 lb. per year by April 1959.

CONSOLIDATED MINING & SMELTING CO. OF CANADA, LTD., Turner Siding, Alta.
Raw material: Natural gas.
Principal products: Ammonia (325 tons per day); ammonium nitrate (200 tons per day); sulfur (20 tons per day).

DEVON-PALMER OILS, LTD., and **TEXAS GULF SULPHUR CO., INC.,** Calgary, Alta.
Construction: Will complete mid-1959, a $6,000,000, 370-ton per day sulfur plant 12 miles southeast of Calgary. It will process 30 M.M.c.f.d. daily of Okotoks gas.

DOW CHEMICAL OF CANADA, LTD., Sarnia, Ont.
Raw material: Hydrocarbon rich stream; benzene; butadiene.
Principal products: Carbon tetrachloride; diethanolamine; diethylene glycol; dichloroethyl ether; ethanolamine ethyl chloride; ethylene glycol; ethylene oxide; hydrochloric acid; perchloroethylene; polystyrene; polystyrene foam; styrene; styrene butadiene latexes; tri-

12 Vertical Pressure Vessels of T-1 Steel,
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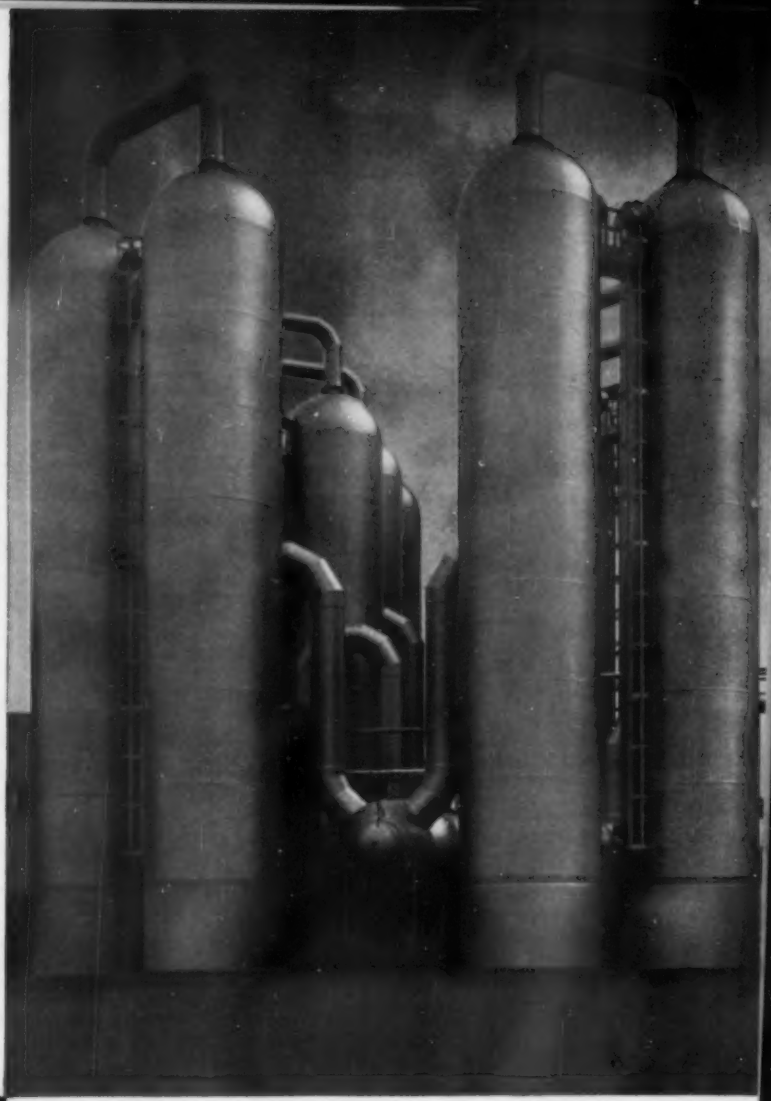

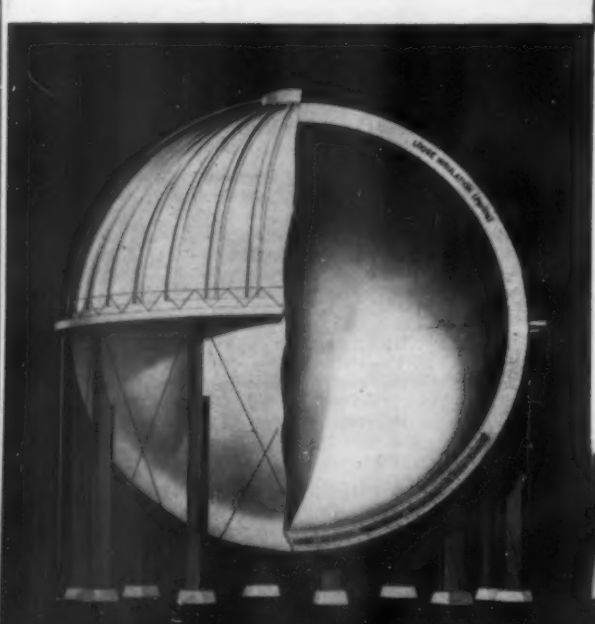

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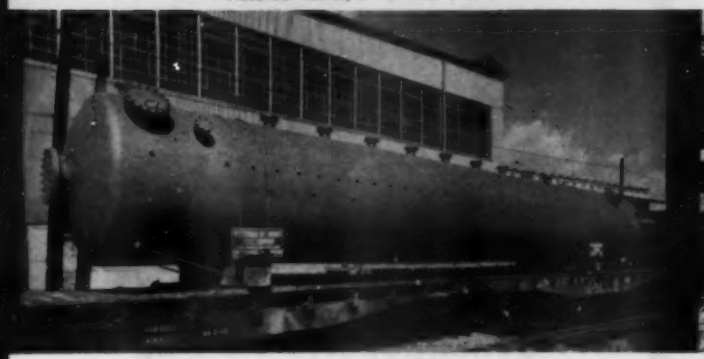
Absorber Tower, 57' 9" x 8' 6".



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MATERIALS—Pittsburgh-Des Moines builds tanks, vessels and structures of steel, stainless steel, stainless clad steel, alloys and aluminum

SERVICES—Pittsburgh-Des Moines' complete service to the client includes *design*, to accomplish required objectives—*selection of material*, proper for service needs—*preparation of detailed drawings*—*fabrication*—and *delivery* and *erection or installation*. Included also are the design, procurement and installation of all associated items such as foundations, pumps, compressors, coolers, dryers, piping, insulation, refrigeration, controls, electric wiring, etc.

SCOPE—The range of PDM product manufacture includes tanks, vessels and plate construction of plates from ¼" to 13" thick, shop-built vessels and structures, weighing up to 100 tons, and field-assembled vessels or structures of any size.

ENGINEERING—The development, design and coordination required for successful completion of the widely varied work of the Company are functions of our Engineering and Research facilities. Our engineering groups comprise men outstanding in creative engineering, structural design, stress analysis, metallurgy, welding techniques, physics, gas dynamics, heat exchange, mechanical, electrical and control work

RESEARCH—PDM Research investigates problems encountered in engineering for which known data or criteria are not available. A large part of our research is devoted to product improvement and the solution of new problems created by unusual and advanced projects undertaken. Materials and conditions for storing various chemical substances, protective coatings for structures and vessels, heat exchange rates and insulation values, etc., are tested and evaluated. From these studies and much related work has come a wealth of data advancing our ablity to serve our customers with better structures at the lowest levels of cost.

INQUIRIES—We invite your inquiries and the opportunity to quote on steel tanks, platework and structural steel fabrication of every type, including design studies, research, engineering, and erection. Consultations will gladly be arranged at your convenience, without obligation of any kind. Write, telephone or wire our nearest office.

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CHICAGO (3)..602 First National Bank Bldg.
EL MONTE, CAL.....P. O. Box 2012
ATLANTA (5)....361 E. Paces Ferry Rd., N.E.
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60150

chloroethylene; triethanolamine; triethylene glycol.
Construction: Has under way expansion projects totaling $9,000,000.

DU PONT CO. OF CANADA, LTD., Maitland, Ont.
Raw material: Cyclohexane; ammonia; carbon tetrachloride; chloroform; polyacrylonitrile.
Principal products: Adipic acid; hexamethylene diamine (nylon intermediates); chlorofluoromethanes; acrylic fiber.
Construction: Hydrogen peroxide facilities will be added by end of 1958. (Du Pont also makes nylon resin at Kingston, Ont.).

DU PONT CO. OF CANADA, LTD., Sarnia, Ont.
Construction: Plans to complete fall 1959, a low-pressure-process polyethylene plant.

ETHYL CORP. OF CANADA, LTD., Sarnia, Ont.
Raw material: Ethyl chloride; ethylene dichloride; ethylene dibromide.
Principal product: Tetraethyl lead.

IMPERIAL OIL, LTD., Sarnia, Ont.
Raw material: Petroleum gas and liquid fractions.
Principal products: Tripropylene (nonene); tetraprophylene (tetramer); detergent alkylate (30,000,000 lb. per year of alkyl aryl benzene); alkylate bottoms aliphatic solvents; ethylene; propylene; butadiene; butylenes; aromatic distillates; aromatic tars; petroleum polymers.

JEFFERSON LAKE SULPHUR CO., Fort St. John, B. C.
Raw material: Sour natural gas.
Principal product: Sulfur (300 tons per day).

JEFFERSON LAKE SULPHUR CO., Calgary, Alta.
Construction: Planning a 425-ton per day sulfur recovery plant on a Mobil Oil of Canada, Ltd., farmout, 19 miles north of Okotoks field near Calgary. It will be operated by Jefferson Lake Petrochemical Co., Ltd.).

LAURENTIDE CHEMICAL & SULPHUR CO., Montreal East, Que.
Raw material: Natural gas.
Principal product: Sulfur (100 tons per day.)

LUBRIZOL OF CANADA, LTD., Niagara Falls, Ont.
Raw material: Petroleum fractions.
Principal product: Lube oil additives.

McCOLL-FRONTENAC OIL CO., Montreal East, Que.
Raw material: Refinery gases.
Principal product: Ethylene.

MONSANTO CANADA, LTD., Montreal, Que.
Raw material: Styrene.
Principal product: Polystyrene.

NORTHWEST NITRO-CHEMICALS, LTD., Medicine Hat, Alta.
Raw material: Natural gas.
Principal products: Ammonia (100 tons per day); high-analysis nitrogen and phosphate fertilizers.

POLYMER CORP., LTD. (Crown owned), Sarnia, Ont.
Raw material: Refinery streams.
Principal products: Styrene monomer; butadiene and butyl rubbers; ethylene; isobutylene; specialty latexes. (Production of all types of rubber in 1957 was 130,000 long tons. Expansion projects just completed increase this figure).

POLYMER CORP., LTD. (Crown owned), Red Deer, Alta.
Construction: Will build a $15,000,000 butadiene plant. Planned capacity is estimated at 25,000 to 30,000 tons per year.

ROYALITE OIL CO., Turner Valley, Alta.
Raw material: H_2S from natural gas.
Principal product: Sulfur (25 to 40 tons per day).

SHELL OIL CO. OF CANADA, LTD., Jumping Pound, Alta.
Raw material: Sour natural gas.
Principal product: Sulfur (90 long tons per day).

SHELL OIL CO. OF CANADA, LTD., Montreal, Que.
Raw material: Propylene; butylenes; benzene.
Principal products: Isopropyl alcohol; acetone; secondary butyl alcohol; methyl ethyl ketone; epoxy resins; detergent alkylate.

SHERRITT GORDON MINES, Fort Saskatchewan, Alta.
Raw material: Natural gas.
Principal products: Ammonia (90 tons per day); ammonium sulfate (100,000 tons per year).

STEELMAN GAS, LTD., Estevan, Sask.
Construction: Completing a $2,000,000 25-M.M.c.f.d. plant to include sulfur recovery of 15 tons per day.

ST. MAURICE CHEMICALS, Div. of Shawinigan Chemicals, Ltd., Varennes, Que.
Raw material: Methanol.
Principal products: Formaldehyde; pentaerythritol.

SUN OIL CO., LTD., Sarnia, Ont.
Raw material: Crude oil.
Principal products: Butylenes.

SURPASS PETROCHEMICALS, LTD., Scarborough, Ont.
Raw material: Petroleum fraction polyalkylated benzene; petroleum oxidates.
Principal products: Petroleum sulphonates and derivatives; corrosion inhibitors; oil additives; rust preventives; esters; lubricating greases (calcium, lithium, bentone, etc.).

1958-59 DIRECTORY

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ETHYLENE STORAGE AND DISTRIBUTION—3 (CONCLUSION)

PETROCHEMISTRY

Pipeliners find favor in

Transporting ethylene

By H. C. SCHUTT, consulting engineer, and A. R. MATTIOLI, Stone & Webster Engineering Corp.

DELIVERY of ethylene from a large producer to various consumers is today principally done by pipeline. Other means of conveyance such as refrigerated tank trucks and railroad tank cars are not commonly used, since mobile equipment of this type is not generally available, nor have regulations been established for safe transportation of ethylene in statewide and interstate commerce.

Pipeline Distribution

Distribution by pipeline has been proved to be practical and economical. The cost of pipelines for this service is of the same order as that for the conveyance of natural gas, approximately $3,200 per inch-mile. Pressures in the order of 400 to 750 psig. are used and the lines are designed for pressure drops in the order of 1.5 to 3 psi. per mile, depending, of course, on the extent of the pipeline system.

Marine Transportation

Marine transportation, using refrigerated cylindrical tanks installed in barges or special self-propelled vessels, appears to be a distinct possibility for distributing ethylene by way of the domestic system of navigable rivers and canals. An existing chemical company planning to expand in the organic chemical field and to use ethylene; e.g., at the rate of 10,000,000 lb. per year, could not very well afford to build its own ethylene plant, especially if it has no access to really low-cost hydrocarbon raw materials.

If its plant is located on a navigable waterway, barge transportation of ethylene from a large-scale producer on the Gulf Coast to its plant may be the most economical way of obtaining the needed supply of ethylene.

Shipping liquid ethylene . . . An average-sized river barge can be equipped with four cylindrical tanks designed to hold liquid ethylene at a temperature of minus 60° F. and lower and a corresponding low pressure. These tanks can be heavily insulated so that the evaporation losses are negligible or the barge can be equipped with a small self-contained refrigeration system to eliminate evaporation loss entirely. The vessel further would have to be furnished with the necessary appurtenances for loading and unloading of its cargo.

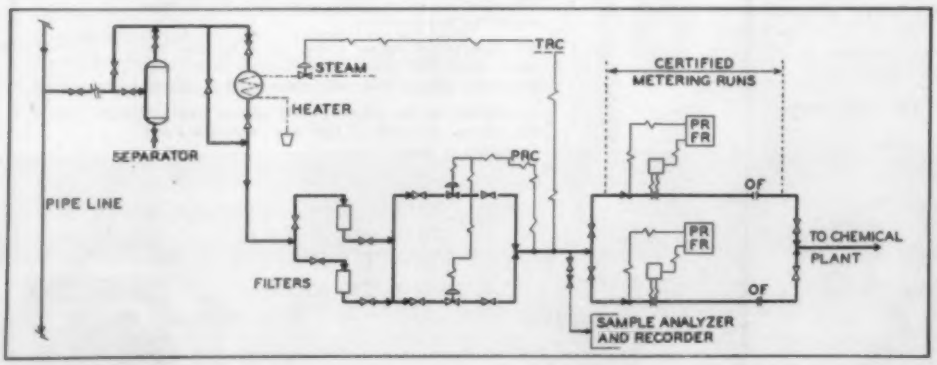
Assuming that the ethylene is in transit for about 3 to 4 days, three barges would be required, each equipped with four 8-ft.-diameter, 40-ft.-long tanks, holding approximately 110 tons of liquid ethylene. One barge would be loaded at the producers' plant, one would be in transit, and one would be at the chemical company's dockside unloading while feeding directly into the process units. The time for loading and unloading would be approximately 7 days. In this manner, expensive terminal storage facilities and intermediate transfers of products would be avoided.

This form of marine transportation of ethylene has found no commercial application as far as the authors know, but it seems to offer an interesting possibility of tying in a more remotely located chemical plant which cannot be economically served by a pipeline, to the large ethylene production centers on the Gulf Coast.

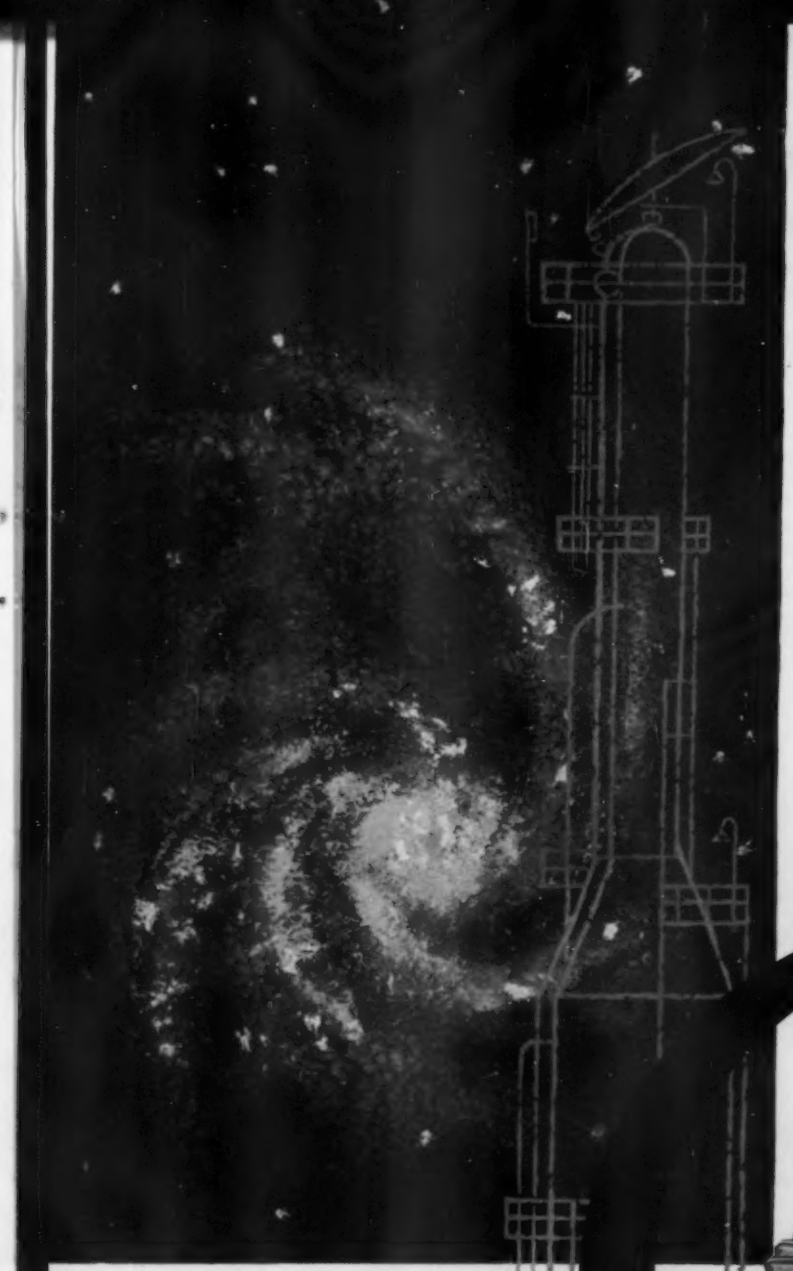
Transoceanic shipment . . . Transoceanic shipment of liquefied petroleum gases, including methane or natural gas, seems to be impending, judging from recent news releases.[1 2 3] One group of companies, a combine of American and British interests, has completed the development of tankers to carry liquefied natural gas from production areas in Venezuela and the Middle East to fuel-hungry western Europe, principally England.

Another group of companies is sponsoring the transoceanic shipment of liquid propane or LPG, principal-

Part 1 of this series appeared on August 4. Part 2 appeared on August 25.



TYPICAL product takeoff and metering station, ethylene-distribution system. Fig. 7.



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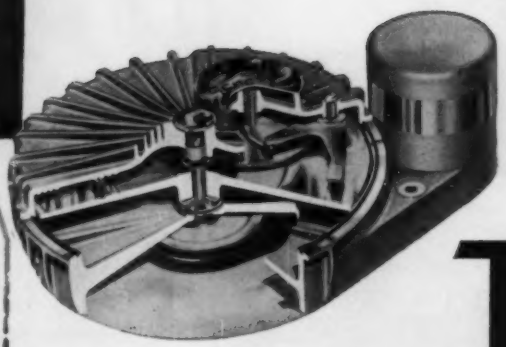

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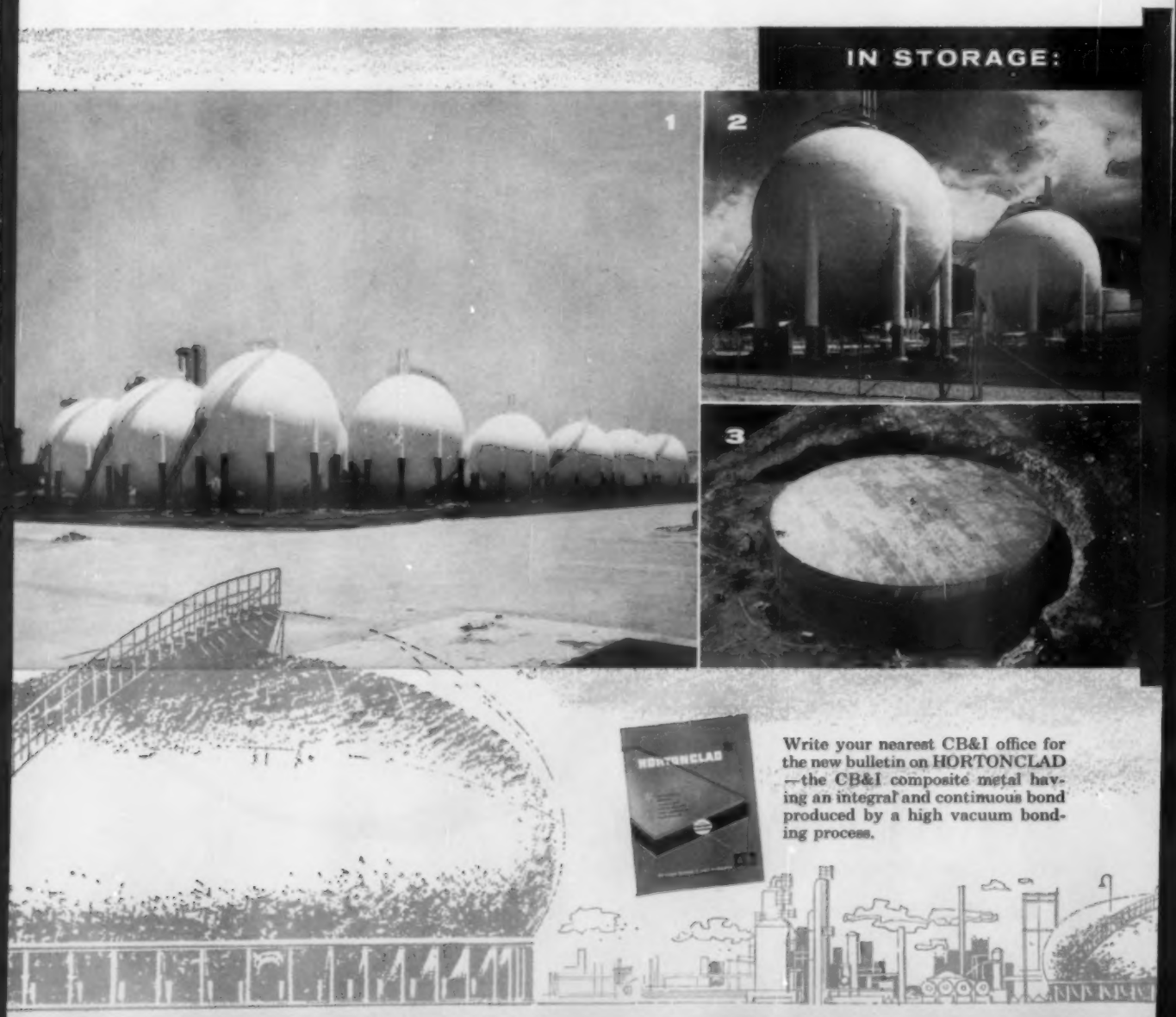

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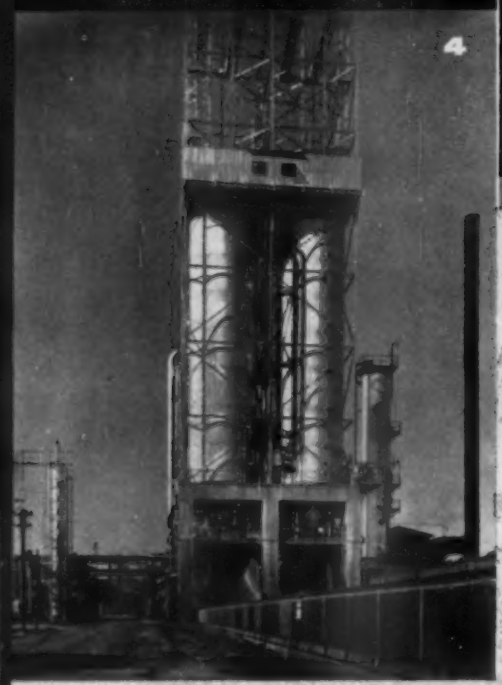

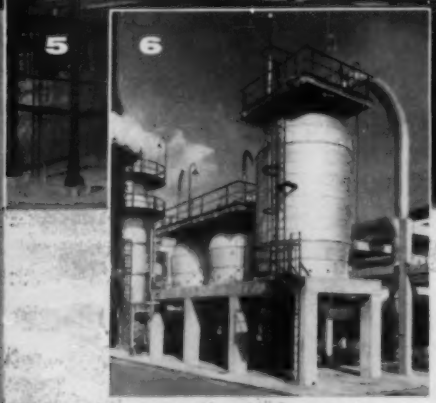

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4 COKING CHAMBERS of stainless steel Hortonclad were fabricated and erected by CB&I at a Kansas Refinery.

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ly to western Germany. It is interesting to observe from the reports so far available that this light-hydrocarbon material will be carried at low pressure and subzero temperatures in heavily insulated tanks, holding evaporation losses to a surprisingly low figure.

LPG and butane are recovered in the stabilization process to which most crude oils are subjected prior to tanker shipment. These light hydrocarbons are, of course, very desirable feed stocks for ethylene manufacture. No doubt a part of these transoceanic shipments will be used for ethylene and synthetic-chemicals production.

Transportation of ethylene as such by seagoing tankers has not received any consideration for the obvious reason that no ethylene-production facilities exist in the Middle East and Venezuela, and are not likely to be built in the near future in view of the political instability of these areas making large capital investments for this type of plant a precarious undertaking. The more realistic approach is the mere recovery of feed stock for ethylene manufacture and its shipment to industrial centers in Europe and this country.

Delivery to Consumers

The large ethylene manufacturer distributes his product by pipeline and the chemical manufacturer draws his supply from this transmission line through a special metering station, a typical illustration of which is given in Fig. 7.

The stream taken off the pipeline passes through a knockout drum, a steam heater to produce a given constant metering temperature, and a filter to strain out any fine particulate matter which may impair the precise functioning of the subsequent control and metering equipment. Bypasses around the just-named apparatus or dual installations are provided to insure uninterrupted flow.

Pressure reduction . . . The ethylene leaving the filter passes through a pressure controller holding a given constant pressure in the line to the metering runs. In some cases where the pipeline pressure is considerably higher than the pressure in the actual metering run, the pressure reduction is done in two stages where the final valve operates within its most sensitive and proportional response range.

Metering run . . . The product then flows through the metering run, which is also provided in duplicate so that the flowmeters can be periodically tested and recertified. The metering runs contain an additional set of orifice flanges to permit the installation of a second set of flowmeters which may be under the sole jurisdiction of the consumers. Also, when the flow is at an appreciably lower rate than the normal takeoff, the second orifice can be of smaller size in order to stay within the range of maximum sensitivity and accuracy of the orifice with respect to variations in flow.

Ethylene concentration . . . A continuous sample drawoff and analyzer is usually provided which records the ethylene concentration of the delivered product. The consumer, of course, expects by virtue of his agreement or contract, a product at or above a certain minimum ethylene concentration and normally pays only for the ethylene and not for the small quantities of methane and ethane associated with it. These fractions may not have even fuel value after passing through the synthesis processes, in view of contamination with chemical reagents and thus form waste material. In many cases the consumer operates final purification facilities to produce a high-purity ethylene and a constant composition of the delivered product is then of real importance to his operations.

In Sum

Ethylene storage and distribution is an important phase of the petrochemical industry and presents many problems of an economic as well as of an engineering and design nature. Plant operations, corporate organization, and policies also enter into the planning and construction of appropriate facilities. An attempt has been made in this article to give a fairly comprehensive coverage of the subject so that it may form a guide in perfecting ethylene plant design and projecting facilities for reliable product delivery to the ethylene-consuming industry.

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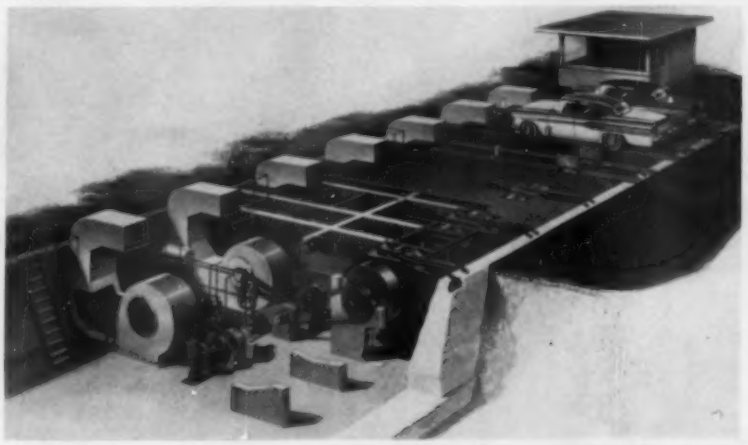
1. Developments; Chem. Eng., April 21, 1958, p. 53.
2. Editorial; The Oil and Gas Journal, Oct. 7, 1957, p. 108.
3. Editorial; Chem. & Eng. News, Nov. 4, 1957, p. 25.



NEW AUTOMATED TREADMILL at Esso Research & Engineering Co.'s Linden, N. J., laboratories. Rear wheels of the cars ride on and rotate wide steel drums, which are belted to "inertia disks" and large fans in an underground pit.

Eight test cars driven together

EIGHT unmanned cars for testing fuels and lubricants can be driven simultaneously on an automated treadmill developed by Esso Rsearch & Engineering Co. The device, operated by one man stationed in a control house, is installed at the Linden, N. J., research center.

Magnetic tape recordings, made during on-the-road runs, control the acceleration and braking cycle of the test cars in an exact duplication of normal driving. The treadmill can be set for fast, uninterrupted turnpike driving, or a combination of both open road and city driving.

Esso Research claims several advantages for the device. It provides more accurate test information than conventional road runs because fuels and lubricants can be compared under unvarying conditions. It also enables the company to make vapor-lock and transmission tests up to 100 m.p.h.

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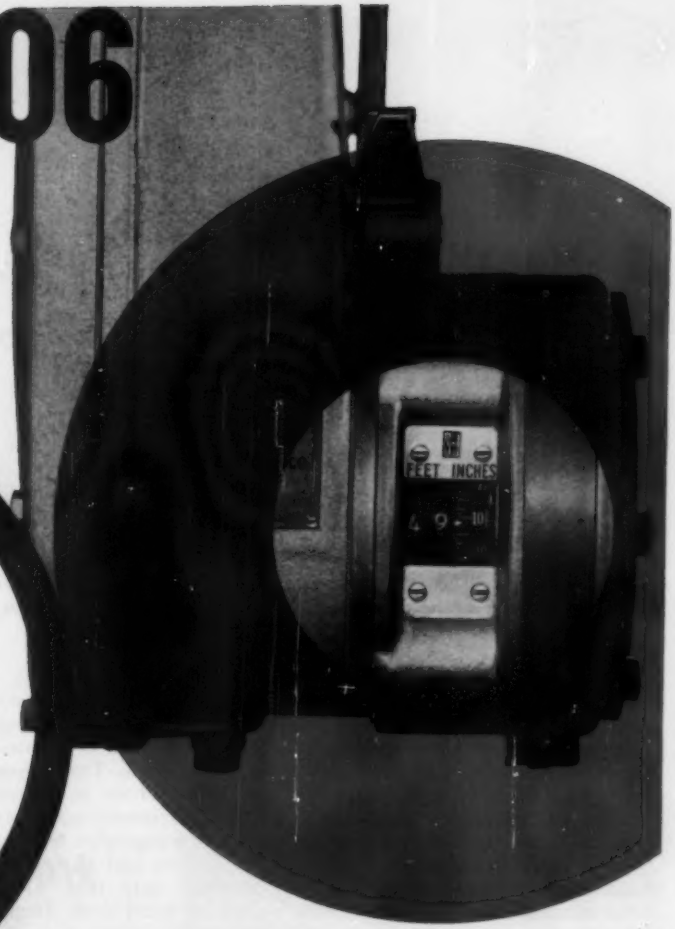

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EXPLORATION

Yugoslavia: young oil province with good undeveloped prospects

BY GEORGE DE MOHRENSCHILDT
Petroleum Geologist and Engineer,
Dallas

YUGOSLAVIA has a young oil and gas-producing history—and oil is very important for the economy of the country.

Prospects for future discoveries appear good although practically no new large oil fields will be uncovered in the northern part of the country.

Nearly all the oil technicians have been trained in Yugoslav universities, and these schools have very high standards. Many of the engineers have visited the United States and learned practical field techniques. These young technicians and scientists do all the work connected with finding and producing oil and gas. Outside of two specialized geophysical enterprises there are no servicing companies in Yugoslavia.

In its tendency to decentralize, the Yugoslav Government has put a very heavy task on all the oil men, possibly too heavy a load. Indeed it is most difficult and expensive for each producing enterprise to have personnel and equipment to secure all phases of the search and development of hydrocarbons. Specialized servicing enterprises should exist.

Another interesting aspect of the Yugoslav oil industry is a keen competition between the oil-producing enterprises. Indeed, initiative is encouraged by the distribution of the earnings among the employes. Workers' councils exist in all enterprises, and play an important part in the management of them. The Yugoslav Government provides a kind of top supervision to all these enterprises as they form part of the Association for the Production and Refining of Oil and Gas.

Also the Federal Geological Institute coordinates and promotes financing of wildcats in the whole republic, while individual enterprises proceed with development of proven fields and finance such development through loans from the national bank. Four republics have their own geological institutes which contribute to the knowledge and development of mineral resources.

Credit should be given to various American oil-field-equipment manufacturers and servicing companies who have sold a lot of good equipment in Yugoslavia and have trained personnel in the operation of such equipment.

Oil Provinces

Most of Yugoslavia is very mountainous, hard of access and geologically unfavorable to the accumulation of hydrocarbons. Therefore the search for hydrocarbons is concentrated in relatively restricted sedimentary basins of small topographic relief, located in the northern part of the country. The geological map (Fig. 1) shows the situation pretty well. These sedimentary basins belong to four republics, namely to Serbia, Croatia, Bosna-Herzegovina and Slovenia.

The Federal Republic of Yugoslavia (FNRJ) is in reality composed of six such republics, which have a great deal of independence. Thus the search, and especially the production of hydrocarbons, is conducted separately by individual republics and only top guidance and some financial support is provided by the federal agencies.

The Republic of Montenegro, located in the southwestern part of the country, in the vicinity of Albania, has also been actively explored for hydrocarbons but there the situation is very complex and the search has not been successful. The prospective new areas of the Croatian Adriatic coast will be described later.

Serbia . . . In the Republic of Serbia only the northern part has been actively explored for oil and gas. This northern district is called Voivodina and geologically it is a sedimentary basin—Pannonia—mostly Quaternary on the surface. All the fields of this basin are producing from the Miocene pays. There is a nice trend of anticlinal structures trending north-south approximately. The structures are not typically anticlinal but rather of anticlinal-stratigraphic type.

In these fields oil or gas are accumulated in lenticular sands surrounding and sometimes overlapping buried igneous hills. Thus, sometimes, the top of the structure is dry and production is found in an irregular manner around these buried hills. The fields were discovered on the basis of extensive gravimetric surveys, followed by detailed seismic work.

The operating enterprise is "Naftagas."

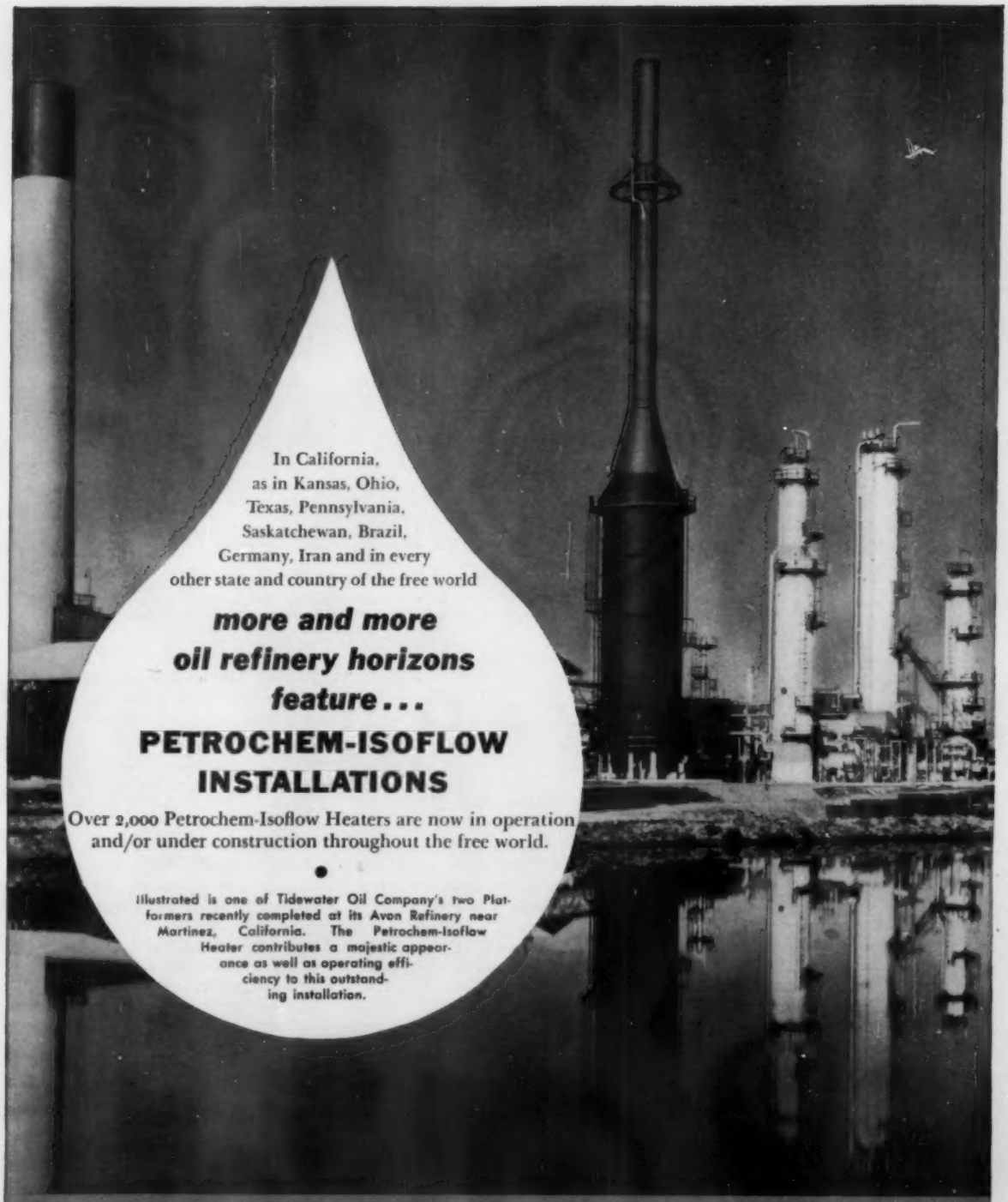
The best field of the Serbian Republic is Jermanovci with about 40 wells completed to date and very few dry holes. The producing area is about 1,200 acres; average depth of the wells is 3,500 ft.; most of them are flowing; there are a few gas wells in the field. Total reserves are about 5 million barrels, possibly 7.5 million barrels with secondary recovery.

Most of the crude in this part of Yugoslavia is heavy, about 21° API, highly paraffinic and viscous (300 cp. at 120° F.), presenting great difficulty of exploitation, especially during the cold months.

There is a lot of drilling activity in the area and several rigs are assigned to wildcat projects.

The Yugoslavs have discovered a small gas field in the trend—Velika Greda field—with about 6,000 producing acres and probable reserves of 9 billion cubic feet. There are six producing wells in the field. But unfortunately gas is not available for the good market of Belgrade because there is no pipeline to the capital. Only a 2-in. line connects this field to a limited market at Vrsac.

There are two newly developed fields in Serbia—namely Lokve and



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Saskatchewan, Brazil,
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more and more oil refinery horizons feature . . .

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Boka—but although looking good potentially, they produce limited quantities of oil only. Serbian oil fields are indicated on the map as Trend A.

Croatia . . . The latest discovery is Levinovac on the Middle Drava River. All of the fields of the Republic of Croatia are operated by the enterprise "Naftaplin" located in Zagreb. This enterprise is now producing about 80% of all Yugoslav oil. Several producing fields are located in the western extension of the Pannonian basin and they are on a well-defined trend as shown on the map.

The fields are not large but quite prolific since some of them have active water drives. All of the wells produce from Miocene and Pliocene formations of Tertiary age. Oil is generally paraffinic 35° API. Average depth of the wells is 3,900 ft.

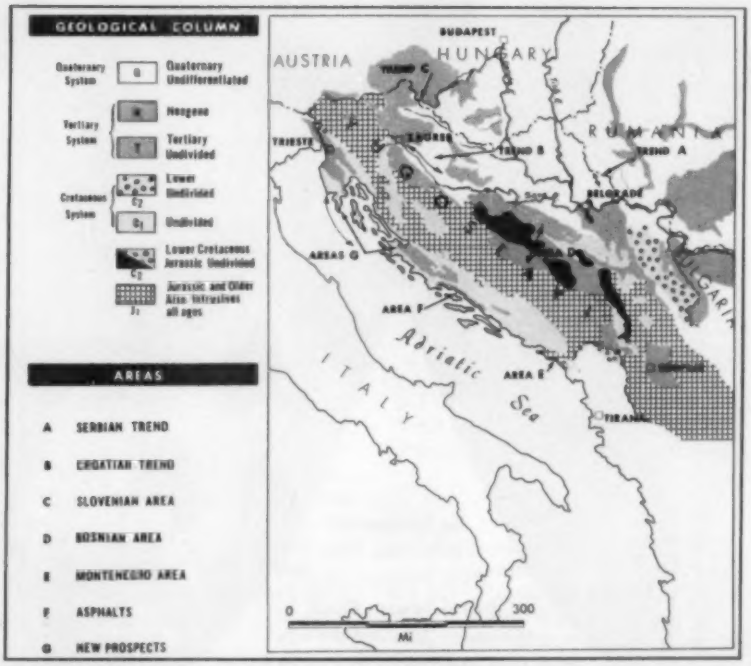
The largest reserves are in Klostar field—9 million barrels and with secondary recovery possibly 15 million barrels. This field produces daily about 4,000 bbl.

The next largest field is Sumecani with total reserves of about 7 million barrels. New discoveries are signaled frequently on this trend of fields, the latest one very shallow, some 1,600 ft. Unfortunately the fields are small in area. Most of the wells have good potentials because the sands are unconsolidated but the decline is fast. A small gas field should be mentioned on this trend—Janja Lipa field, about 50 miles from Zagreb, and a gas line from this field goes to Zagreb and Sisak. Croatian oil fields are indicated on the map as Trend B.

Slovenia . . . The two producing fields of the Republic of Slovenia are operated by the enterprise "Nafta Lendava" located in the town of Lendava. The field of the same name, although comprised of several reservoirs, has been operated for several years and is in the process of being repressured with gas. Total recoverable reserves of Lendava field from various reservoirs are about 3.5 million barrels.

One of the reservoirs contains gas and a gasoline plant of a limited capacity is in operation to treat casinghead gas and the reservoir gas. The dry gas is used for repressuring the oil reservoirs. Oil is of high gravity (40° API) paraffinic crude. Average depth of wells over 5,500 ft.

A new field is being developed by Nafta Lendava in Filovci in close vicinity to Lendava. Here the depths are greater and difficulties of completion considerable. At the end of 1957 two wells were on production. There are two distinct oil and gas reservoirs. Slovenia oil fields are indicated on the map as Area C.



GEOLOGICAL MAP shows relatively restricted sedimentary basins in northern part of country, belonging to Serbia, Croatia, Bosna-Herzegovina, and Slovenia. Fig. 1.

Production and exploration . . . The three above-mentioned republics produce all the oil of Yugoslavia and this production has increased from 8,000 bbl. in 1939 to 200,000 bbl. in 1946, to 1,060,000 bbl. in 1951, to 3,000,000 bbl. in 1957, and probably to 3,500,000 bbl. in 1958. This will represent about 50% of the total need of oil of Yugoslavia and will equal 50% of the total capacity of the three Yugoslav refineries. Naturally the Yugoslav Government is trying ultimately to achieve an independence from oil imports (Middle East and the Soviet bloc).

Search for oil and gas is conducted actively in two other republics—Bosna-Herzegovina and Montenegro. The first one has an enterprise called "Nafta Tuzla" located in Simin Han, the other "Nafta Crnagora" located at Bar. Both enterprises have been prospecting and drilling for several years.

Bosna-Herzegovina has unfortunately a very narrow and faulted Plio-Miocene basin near Tuzla indicated on map as "D" area, where noncommercial production was discovered by the Yugoslav State Monopoly before World War II. Although some surface structures have been located in this basin, they have not been substantiated by seismograph. Only one structure with fairly good seismic control remains to be drilled.

The same may be said of the Republic of Montenegro, indicated on the map as Area E, where the search is concentrated mainly near the coast. There the outcrops are of Tertiary, Cretaceous, Jurassic, and Triassic ages and are highly disturbed by the Sava orogeny. It is an area of overthrusts and of "charriage."

Because of this highly complex geology, and notwithstanding surface indications of hydrocarbons, all attempts to find oil have been unsuccessful. Probably the deepest well in Europe was drilled there (14,580 ft.) which provided a lot of geological information but no production.

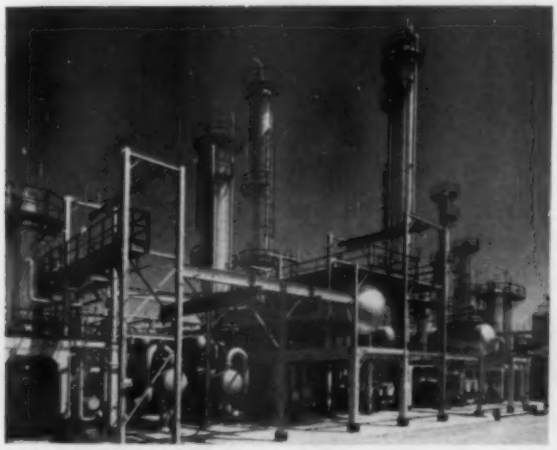
Further north from the coast of Montenegro and along the Adriatic Coast in the Republic of Croatia there are interesting and important asphalt deposits. One of them on the island of Brac, indicated on map as Area F, has been mined for centuries. These deposits are, however, in the highly disturbed area geologically and search for oil would be there most hazardous.

Yet further north, in two regions, geology is less disturbed and clear-cut surface anticlines are found near the town of Zadar and on the Peninsula of Istra indicated on the map as Area G. There surface deposits are of Tertiary and Cretaceous ages. Gravity and magnetic explorations have already been completed, seismic exploration is in the process of being completed and drilling will be attempted soon.

Use of elevation sketch of alky plant assists planning engineers and maintenance crews in turnaround at Cosden. Supplemental folder provides details and check list as . . .

Visual aids speed turnaround

BY LARRY RESEN
District Editor

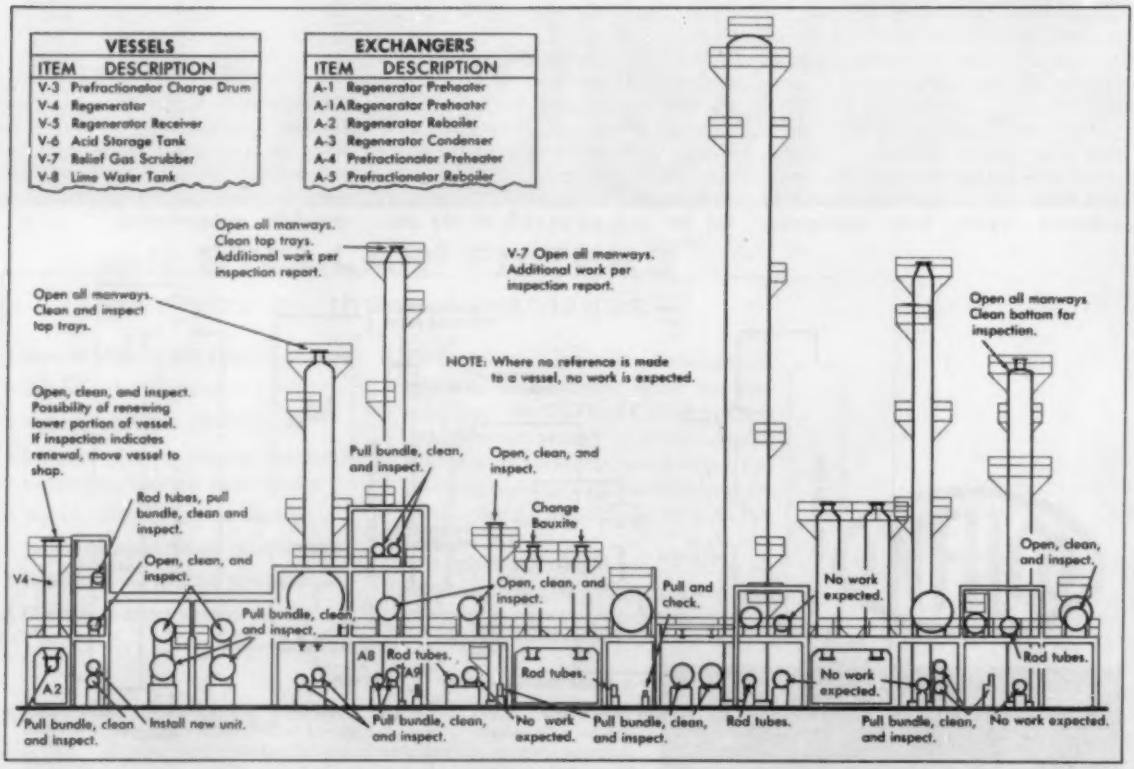


ALKYLATION UNIT, Cosden refinery. Fig. 1.

CAREFUL PLANNING and detailed sketches are being used by Cosden Petroleum Corp. to expedite turnarounds at its Big Spring, Tex., refinery (Fig. 1).

Use of an elevation broadside sketch of the HF alkylation unit played an important part in the actual planning and execution of an overhaul on these facilities.

The blue-line print was marked up with red pencil to show work required during the turnaround. Posted in the unit, it provided a ready reference to maintenance crews as they planned their work, and during the turnaround itself. The sketch was used in conjunction with a special unit turnaround folder. Together, these items insured that all parts of the unit received due attention with a


VESSELS
ITEM DESCRIPTION
V-3 Prefractionator Charge Drum
V-4 Regenerator
V-5 Regenerator Receiver
V-6 Acid Storage Tank
V-7 Relief Gas Scrubber
V-8 Lime Water Tank
EXCHANGERS
ITEM DESCRIPTION
A-1 Regenerator Preheater
A-1A Regenerator Preheater
A-2 Regenerator Reboiler
A-3 Regenerator Condenser
A-4 Prefractionator Preheater
A-5 Prefractionator Reboiler
Open all manways. Clean top trays. Additional work per inspection report.
V-7 Open all manways. Additional work per inspection report.
Open all manways. Clean and inspect top trays.
Open all manways Clean bottom for inspection.
NOTE: Where no reference is made to a vessel, no work is expected.
Open, clean, and inspect. Possibility of renewing lower portion of vessel. If inspection indicates renewal, move vessel to shop.
Pull bundle, clean, and inspect.
Open, clean, and inspect.
Change Bauxite
Rod tubes, pull bundle, clean and inspect.
Open, clean, and inspect.
V4
Open, clean, and inspect.
Pull and check.
No work expected.
Open, clean, and inspect.
Pull bundle, clean, and inspect.
A8
Rod tubes.
A9
Rod tubes.
No work expected.
Rod tubes.
A2
Pull bundle, clean and inspect.
Install new unit.
Pull bundle, clean, and inspect.
No work expected.
Pull bundle, clean, and inspect.
Rod tubes.
Pull bundle, clean, and inspect.
No work expected.

WORKING ELEVATION SKETCH of Cosden's Big Spring alkylation unit, with notations to facilitate turnaround on the unit. Fig. 2.

minimum of confusion and a maximum of efficiency.

The "working elevation sketch" in Fig. 2 indicates the extent to which planning engineers went in providing a visual check sheet to the maintenance crews. In the upper left portion of the sketch are located keys which describe the numbered vessels and equipment on the sketch itself. Experience during a recent turnaround showed that a column devoted to the gasket schedule was desirable. This will be included on future jobs.

Marking of the chart pinpointed both minor and fairly major turnaround jobs. Thus the regenerator, vessel V-4 at the left of the sketch, was earmarked to be opened, cleaned, and inspected. At the same time, a notation was made which points up the possibility that the lower portion of the vessel might have to be renewed. This would require shop facilities. The regenerator reboiler, vessel A-2, meanwhile, simply had to have its bundle pulled, cleaned, and inspected.

In many instances, no work was required on certain pieces of equipment. In some cases no notation was made on these items. In other instances, the notation "no work expected" was penciled in on the sketch. This was to avoid confusion where similar pieces of equipment were installed. Heat exchangers A-8 and A-9 are side by side, but only A-8 is earmarked to have its bundle cleaned. Hence, the "no work expected" note on A-9.

The turnaround folder includes a tabulation of all jobs so a double check was assured between the sketch and these tables. Additionally, where extensive repairs were anticipated, supplementary information was included in the unit folder. In the case of the regenerator, V-4, the work description as outlined on the elevation sketch was included in the folder tabulation.

"The visual aspect of the elevation sketch coupled with the details and check lists of the folder combined to provide a master turnaround plan for the alkylation plant."

As was noted earlier, there was a possibility that the lower section of the regenerator might require shop repairs. The folder work sheet also noted this and added that the crew should "follow attached sketch and notes." The appendix of the turnaround folder includes this sketch plus detailed notes on preparing the vessel for removal to the shop. Other sketches and detailed information were also included in the folder for other equipment as might be required.

An important facet of turnaround operation is the description and availability of gaskets. As was noted, a table will be included in futurer elevation sketches to list gasket schedule for the unit. The planning phase of the turnaround included a tabular listing in the folder of gasket availability. This was done to insure against short supply when the job was in progress. Ordering was done on the basis of the availability check list.

The folder included a tubular listing of blind locations to insure that the unit was isolated during the turnaround period. A simplified flow chart was included to show the auxiliary pump, vat and piping arrangement necessary to install for neutralizing the acid section of the unit. Caustic was prepared in the vat and pumped into the prefractionator. Flow was split out of the top of the prefractionator (Fig. 3).

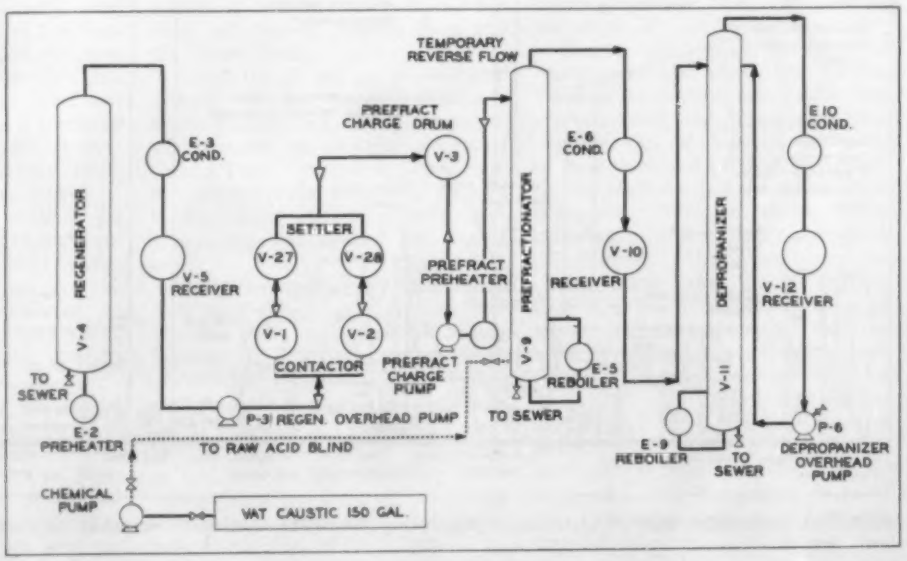
In the one case, the flow went overhead into the depropanizer system. In the other case, the flow was in reverse to the normal process flow. Caustic left the prefractionator through its inlet lines and was charged to the normal outlet line of the regenerator after first passing in reverse flow through the prefractionator charge drum, the settlers, contactors, and auxiliary equipment in the process.

The heat-exchanger schedule as shown on the elevation sketch was amplified in the folder tabulation. Test pressures of the shell and tubes were included in this rundown plus a work description. Also included was a column for pertinent remarks. Other tabulations included a check sheet for all relief valves, which included their location, make, size, and cold setting.

The visual aspect of the elevation sketch coupled with the details and check lists of the folder combined to provide a master turnaround plan for the alkylation plant. Careful planning and attention to detail paid off in a simplified unit turnaround.

Acknowledgments

Cooperation of the management of Cosden Petroleum Corp. in the release of this information and the assistance of W. D. Broughton, planning engineer, in its preparation is gratefully acknowledged.



SIMPLIFIED FLOW CHART is included in folder which accompanies main working elevated sketch. Fig. 3.

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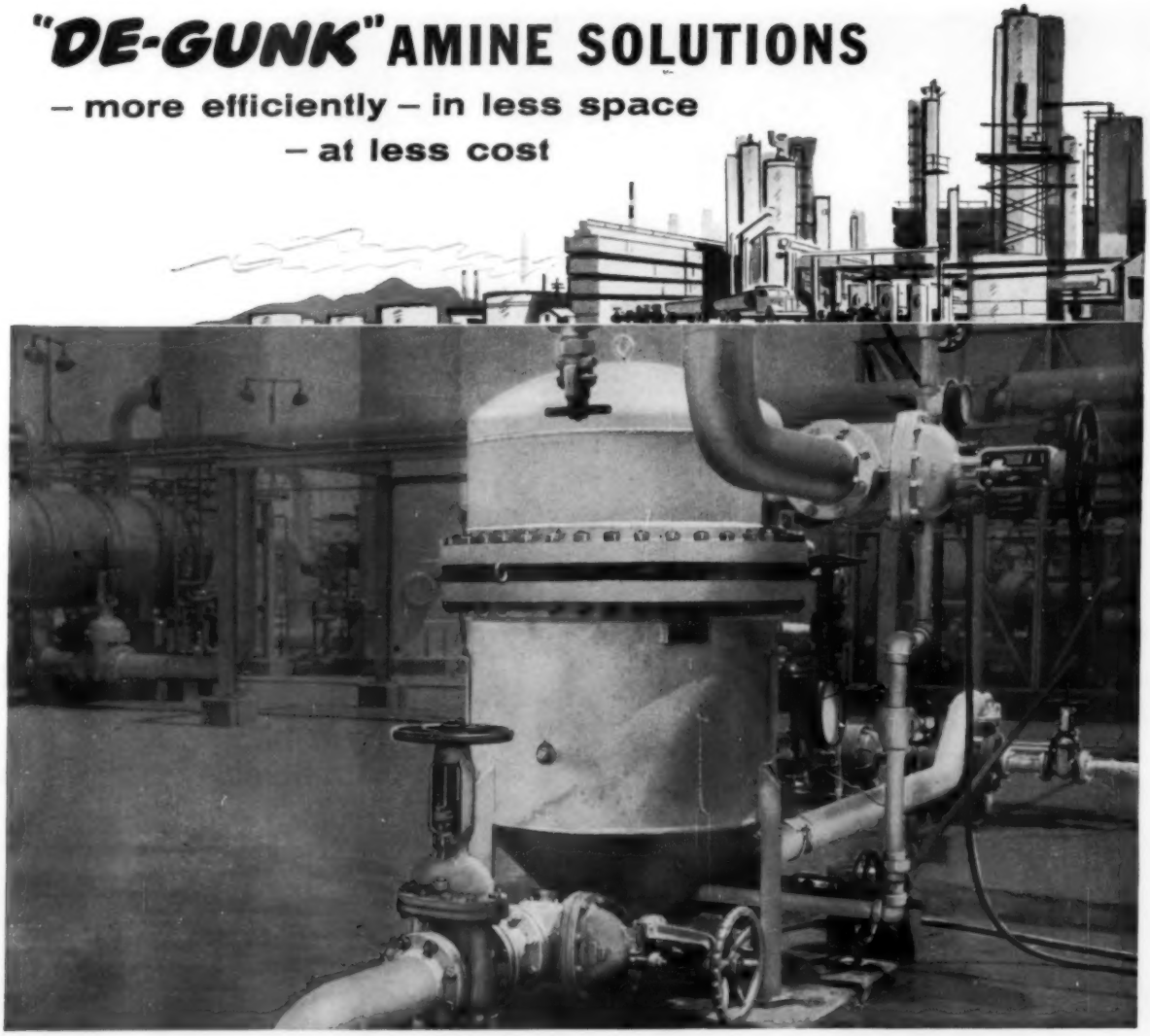

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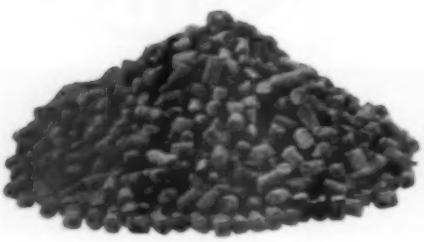

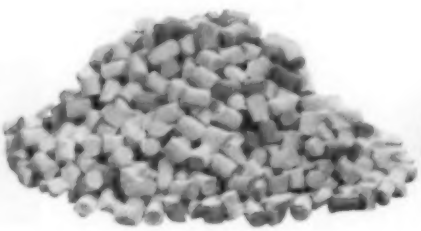

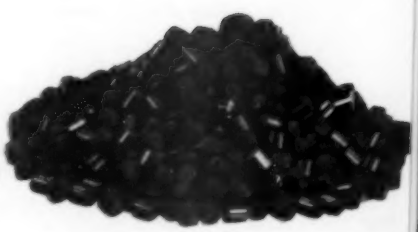

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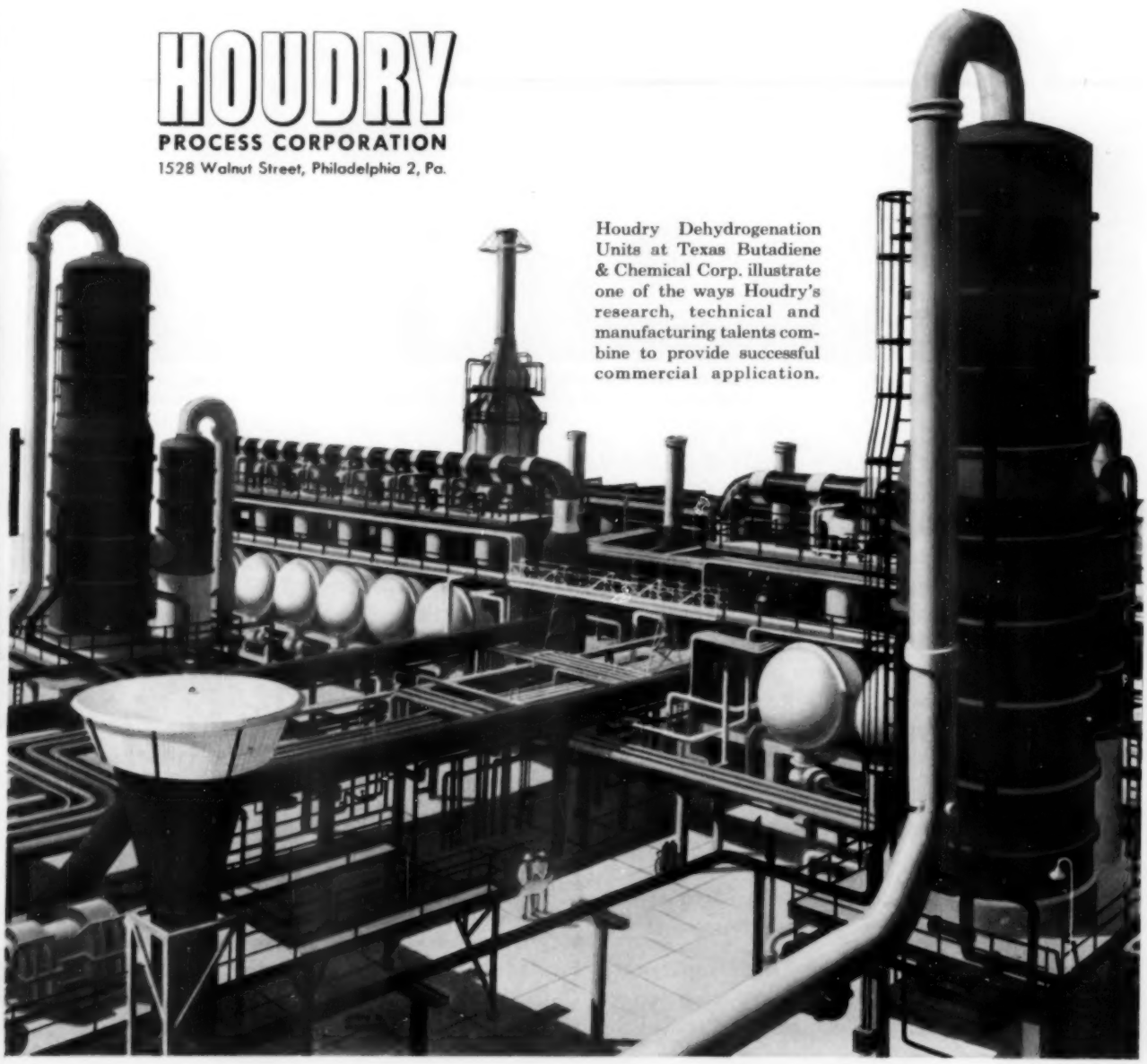

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BY W. L. NELSON
Technical Editor and
Petroleum Consultant

What are "large," "average" and "most out of date" tankers?

In connection with your answer of October 21, 1957—

1. What would you say was the average size for tankers you class as "large," "average," and "most out of date?"

2. Do you have ways of ascertaining how many tankers are under construction and the approximate number that will be launched each year for the next 5 years?

3. About how much investment is involved in the average "large" tanker? F.C.W.

These questions are more specific than the data ordinarily available. However, the average size of tankers during several years has been about:

	No. vessels in service	Dw. tons
1940	1,637	7,140
1942	1,550	7,250
1944	1,556	7,640
1945	1,911	8,110
1949	1,955	8,310
1950	2,056	8,540
1951	2,131	8,650
1952	2,292	8,910
1953	2,502	9,380
1956	2,519	16,700
1957	2,476	18,100

Large tankers are considered variously as those of 30,000 to 40,000 dw. tons (although some authors have recently classed 20,000 tons as "large"). Each year the largest tankers under construction are the "supertankers." This means for 1957, tankers larger than about 60,000 dw. tons. Although a tanker can operate far longer than 15 years, the rate at which new tankers have been launched has been so fast that most of the tankers that are 12 or more years old are not considered as economically useful except when tanker rates are favorable. They are "out of date."

With respect to the current rate of construction, refer to the December 30, 1957, issue The Oil and Gas Journal, page 196 (Winterbottom, Tanker-Building Boom . . .). Therein are listed the known orders throughout the world, up to the date of 1965.

Scarcely any information is available to this department regarding tanker costs, and such costs present difficulty because of the very great differences in labor costs throughout the world. However, here are a few figures:

	Dw. tons	$ per ton	Notes
1955	32,000	130.00	Japanese yard (10c/hr. and up)
1955-58	.....	*150.00	German yard
1955	25,000	300.00	U.S.A. $1.80/hr.)
1955	35,500	141.00	Italian yard

*Escalation to care for increases in labor costs.

Sulfur content of U. S. crudes is decreasing slightly

What is the average sulfur content of crude oil produced in the U.S.A.? R.W.P.

At the present time the sulfur content of U. S. production is about 0.65% (see Fig. 1). Crude oil imported from the Middle East contains about 2% sulfur and that from Venezuela probably exceeds 1.3% (the exact gravity is not known). Thus, the crude oil being processed in the U.S.A. probably has a sulfur content of 0.72-0.76%. However, most of the foreign high-sulfur oil is processed in a few refineries on the East Coast.

Precise information involves much statistical work (as well as numerous estimates) and accordingly only the approximate data of Fig. 1 are available. The triangle points are based on studies made by the author on the 99 largest fields during the period 1927-1936 (OGJ, July 29, 1937, p. 91). The circle points were obtained from the excellent paper by Shelton, McKinney, and Blade, of the U. S. Bureau of Mines (Pet. Refiner, May 1927, p. 257), by assuming the following average sulfur contents:

Over 2.0%	2.40
1.01-2.0	1.40
0.51-1.0	0.70
0.26-0.5	0.35
Under 0.25	0.15

Two sets of data check reasonably well on such a basis.

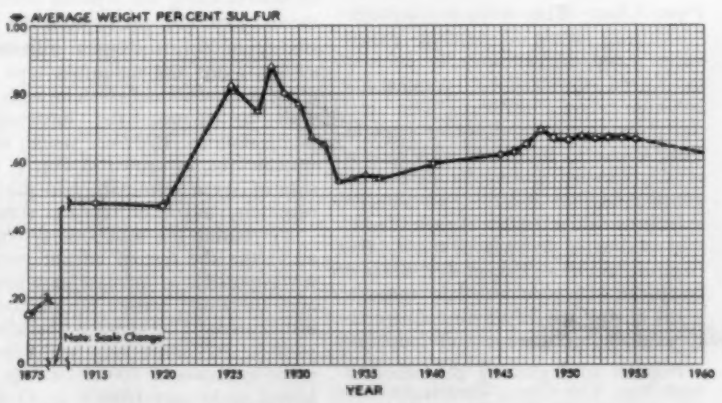


Fig. 1—Average sulfur content of U.S.A. crude oils (approximate).

The equipment lifted atop 9,800-ft. Roof Butte by this helicopter was used to construct the first . . .

Microwave system for Four Corners

A PRIVATELY OWNED communication system was seen to be the only means by which reliable service could be furnished for the Four Corners Pipe Line. The country through which this crude-oil pipeline passes varies from one extreme to another in regard to available commercial communication facilities. The initial pump station and feeder lines in Four Corners are located in a section of the country practically devoid of communications according to modern standards, while the Los Angeles terminal is situated in an area having the best of facilities. Except for isolated instances, the pipe was laid through areas having few, if any, commercially available communication facilities.

Prepared by engineering department of Shell Pipe Line Corp., construction and operating agent for Four Corners Pipe Line Co., under supervision of O. W. Heyden, chief engineer.

A preliminary survey soon confirmed the fears that it would be highly impractical to build any sort of system along the pipeline route. A second look brought to light the possibility of constructing a microwave system along the mountain tops creating a "backbone" system with laterals to connect the intermediate pump stations. The final system of 15 installations, as shown in Fig. 1, consists of seven terminals, five junction repeaters, and three repeater stations.

By routing the backbone system so as to use the terrain advantageously, it was possible to increase path lengths and, therefore, reduce the number of installations. The average "backbone" path is 70 miles long with several paths in excess of 100 miles. The five lateral paths vary from 8 to 42 miles in length. The total system mileage is 795 miles.

Microwave Equipment

The Four Corners' microwave equipment is a General Electric Type UA-1-D system operating in the 1850-1990 m.c. operational fixed band. The transmitter is crystal controlled using a 90-m.c. crystal oscillator having the stability and accuracy of 0.01% of the carrier frequency.

Conservatively rated stages provide the necessary frequency multiplication and drive to operate a GL-2C39B lighthouse amplifier in the output stage, which delivers a peak power output of 20 watts under pulsed carrier modulation. The high power output provides high system gain which is used either to provide better fading margins or lower-cost installations through the use of lower gain antennas and transmission line of higher loss.

In using a crystal-controlled trans-

mitting equipment, a statement of frequency measurement need be made only once every 6 months in order to comply with Federal Communications Commission requirements. Also, transfer to standby equipment is accomplished in minimum time since no "drift-on" time is required for the standby unit to become stabilized.

The microwave receiver consists of an attenuator, input cavity, mixer and an IF (intermediate frequency) amplifier. A small amount of RF (radio frequency) energy is coupled from the transmitter just described to the mixer where it is heterodyned with the incoming signal to obtain the 60-mc. IF signal.

A variable attenuator which is continuously variable from 0 to 30 db. and operated by a front-of-panel control, permits an immediate check of fading margins and path performance without interruption of communications. The mixer is coupled to the IF amplifier, where a 60-db. range a.g.a. (automatic gain control) is applied to all IF stages with the exception of the cascade input circuit. Video detection is accomplished by a diode which is then followed by a cathode-follower output tube.

The duplexer provides two four-section RF bandpass filters, one between transmitter and antenna and the other between the receiver and antenna. The attenuation between the transmitter and receiver is sufficient to permit simultaneous transmission and reception over one antenna and one transmission line.

Time-Division Multiplexing

The microwave multiplexing system performs its function of applying from 1 to 25 audio channels to the RF system by the time-division (TD) method more specifically described as pulse position modulation (PPM). In a TD multiplexing system, each channel is allocated a small portion of the time in which to accept or reject intelligence to or from the main carrier.

"In using a crystal-controlled transmitting equipment, a statement of frequency measurement need be made only every 6 months in order to comply with FCC requirements."

In order to provide the quality required by present-day standards, it is necessary that the individual channels be sampled at least twice per cycle for the highest frequency to be transmitted over each channel. This system uses a repetition rate of approximately 9 kc., which means that a sample is taken every 112 seconds, or nearly 2½ times per cycle in the case of the highest channel frequency (3,500 c.p.s.).

With PPM, the rate at which the channel sample crosses its normal (centered) position in the pulse train is determined by the frequency of the modulating wave, and the amount of swing about the normal position is determined by the amplitude of the modulating signal. Direct current and low-frequency alternating-current signaling are transmitted by the insertion and removal of the channel sample (pulse) at the signaling rate. The channel pulse may or may not be absent from the pulse train when the channel is not in use.

Since all channel selection and detection of intelligence is based on time and position relationships of the channel pulses, it is necessary also to transmit a time reference which is called the sync pulse and consists of three 0.5-microsecond pulses spaced 1 microsecond apart. Channel pulses are 0.5 microsecond in duration, spaced 4 microseconds apart (center position), and are modulated plus or minus 1 microsecond for 100% modulation.

Unit Functions

The basic functions of some of the units used in this multiplex system are described briefly:

1. **Transmitting sync generator:** Originates the synchronizing pulse and the quadrature waveform used in initiating the gating of the channel modulators.

2. **Receiving sync generator.** Detects and separates the synchronizing pulse from the received pulse train; and from this sync pulse as a reference, generates the quadrature waveform used in initiating the gating of the channel demodulators.

3. **Auxiliary sync generator.** Used at multiplexed repeaters, where its function is to generate an auxiliary sync pulse in the event of failure or introduction of noise on the video train being received.

4. **Blanking and switching unit.** Used as multiplexed repeaters, where it serves to perform video bridging by the removal and insertion of channel pulses in the pulse train.

5. **Channel unit.** Accomplishes the modulation and demodulation of the channel pulse; it is synchronized to the 9-kc quadrature sine waves from the sync generator in order that the intelligence being presented to it is passed only at the time allocated to the particular channel; all units are identical and interchangeable.

6. **Termination units.** Perform the function of translating the intelligence delivered by the channel units into a form usable by the terminal apparatus.

At a repeater, the multiplexing equipment performs essentially the same functions as at a terminal, except that the modulators and demodulators are duplicated in each direction of transmission in the case of a party-line circuit, and blanking and switching units are required. The blanking and switching units permit the station (when off the hook) on a party line to be heard, and also permit hearing from both directions simultaneously without push-to-talk.

If the station is not in use (on the hook), it is completely bypassed thereby avoiding any distortion to through transmission by virtue of demodulation—remodulation of the signal. This particular characteristic of the multiplex equipment has been advantageous in that the failure of a channel unit on a leg circuit does not affect through transmission of that channel on the backbone circuit.

TABLE 1—DETAILS OF MICROWAVE SYSTEM

Location—	Tower		Elev., ft.
	Height, ft.	Type	
Los Angeles Terminal	160	Self-supporting	31
Butler Mt. Junction Repeater	140	Guyed	8,352
Corona Station	120	Guyed	609
Tip Top Mt. Junction Repeater	20	Self-supporting	7,519
Twentynine Palms Station	60	Guyed	2,023
Granite Mt. Repeater	100	Guyed	3,987
Haulpai Mt. Junction Repeater	100	Guyed	7,440
Kingman Station	20	Self-supporting	3,894
Williams Mt. Repeater	60	Self-supporting	9,264
Mt. Elden Junction Repeater	60	Self-supporting	9,349
Cameron Station	120	Guyed	4,552
Marsh Pass Repeater	300	Guyed	7,327
Roof Butte Junction Repeater	100	Guyed	9,790
Red Mesa Station	40	Guyed	5,360
Farmington District Office	40	Self-supporting	5,374

The foregoing multiplex scheme embodies a new approach to time-division multiplexing in that no video pulses, delay lines, or bias voltages together with complex waveforms are used to achieve timing. Instead, low frequency sine-wave voltages are used in conjunction with precision resistance-capacitance networks to accomplish synchronization. Some advantages offered by this scheme are: (1) greater reliability; (2) lower initial cost; (3) fewer vacuum tubes; (4) improved stability; (5) fewer adjustments; (6) simplified maintenance; and (7) more compact design.

Full RF standby and standby for common multiplexing equipment together with the necessary fault-detecting equipment is provided at all microwave installations. The RF receiver, transmitter and associated power-supply standby units automatically transfer as individual items and not as a complete RF standby bay.

Remote Control

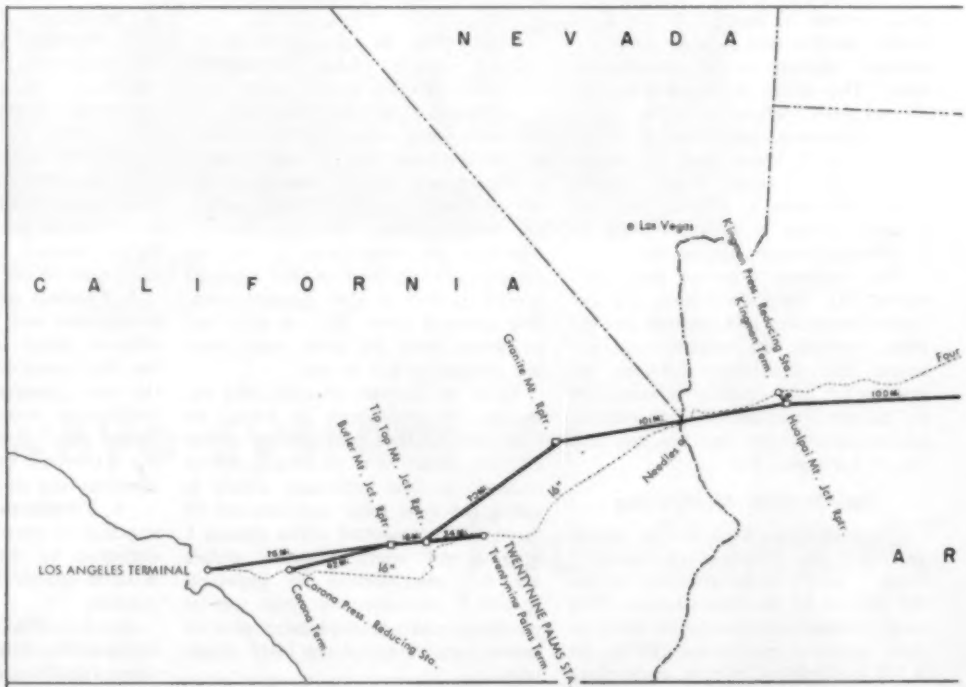
Initially, the system utilizes 9 of a possible 25 channels in supplying circuits necessary to the operation of both the microwave system and pipeline. These channels are shown diagramatically in Fig. 2. An unusual feature in this system is the incorporation of a microwave supervisory on the alarm channel so as to facilitate remote control of the following functions at indicated installations:

A. All microwave installations.

1. Voltage drop test (all power reduced 10% for predetermined time).
2. Exercise standby common multiplex.
3. Lock-up standby common multiplex.
4. Release locked-up standby common multiplex.
5. Release locked-up normal common multiplex.
6. Exercise east standby RF.
7. Lock up east standby RF.
8. Release locked-up east standby RF.
9. Release locked-up east normal RF.

B. All microwave repeater installations.

10. Exercise pulse restore east.
11. Lock up pulse restore east.
12. Lock-out pulse restore east.
13. Exercise west standby RF.
14. Lock up west standby RF.
15. Release locked-up west standby RF.



MICROWAVE CHANNEL DIAGRAM

Circuit No.	Description	Los Angeles Term.	Butler Mt. Jct. Reptr.	Corona Sta.	Tip Top Mt. Jct. Reptr.	Twenty-Nine Palms Sta.	Granite Mt. Reptr.	Hualpai Mt. Jct. Reptr.	Kingman Sta.	Mt. Williams Reptr.
1	Service Channel	●	●	●	●	●	●	●	●	●
2	Microwave Control & Alarm	●	●	●	●	●	●	●	●	●
3	Party Line, Dial Selective Talking	●	●	●	●	●	●	●	●	●
4	East Party Line, Dial Selective VHF Control	●	●	●	●	●	●	▽	●	▽
5	West Party Line Dial Selective VHF Control	●	▽	●	▽	●	▽	●	●	●
6, 7, 8	Pipe Line Control, Tank Gauging and Telemetering	●	●	●	●	●	●	●	●	●
9	Private Talking - Los Angeles to Farmington	●	●	●	●	●	●	●	●	●

FINAL microwave system to Four Corners has 15 installations: seven terminals, five junction repeaters, and three repeater stations. Fig. 1.

16. Release locked-up west normal RF.
17. Exercise pulse restore west.
18. Lock up pulse restore west.
19. Lockout-out pulse restore west.
20. Exercise north standby RF.
21. Lock up north standby RF.
22. Release locked-up north standby RF.
23. Release locked-up north normal RF.
84. Exercise north standby common multiplex.
25. Lock up north standby common multiplex.
26. Release locked-up north standby common multiplex.
27. Release locked-up north normal common multiplex.
28. Exercise standby power audible monitor.
29. Exercise standby generator.
30. Lock up standby generator.
31. Telemeter generator No. 1 (voltage and frequency).
32. Telemeter generator No. 2 (voltage and frequency).
33. Energize standby tower beacon (Marsh Pass only).

The above functions can be accomplished from any point in the microwave system by dialing a two-digit code for the desired location followed by a two-digit code for the particular function desired.

Alarm functions are recorded at Los Angeles terminal by means of codes printed on tape. The code identifies the particular station followed by coded signal reporting the particular type of fault. The fault locating unit is capable of handling six coded groups. A typical group would include:

1. RF transfer.
2. Normal power application.
3. Standby.
4. Tower beacon failure.
5. Tower side light failure.
6. Pulse restoration operation.

How Channels Are Used

For telephone communications, one circuit is utilized for duplex private-line operation between the Los Angeles terminal and Farmington district office. The Los Angeles end of this circuit is terminated on lease private automatic branch exchange facilities and operates as though it were another station within the terminal for outgoing calls while all incoming calls are handled by the terminal PBX attendant.

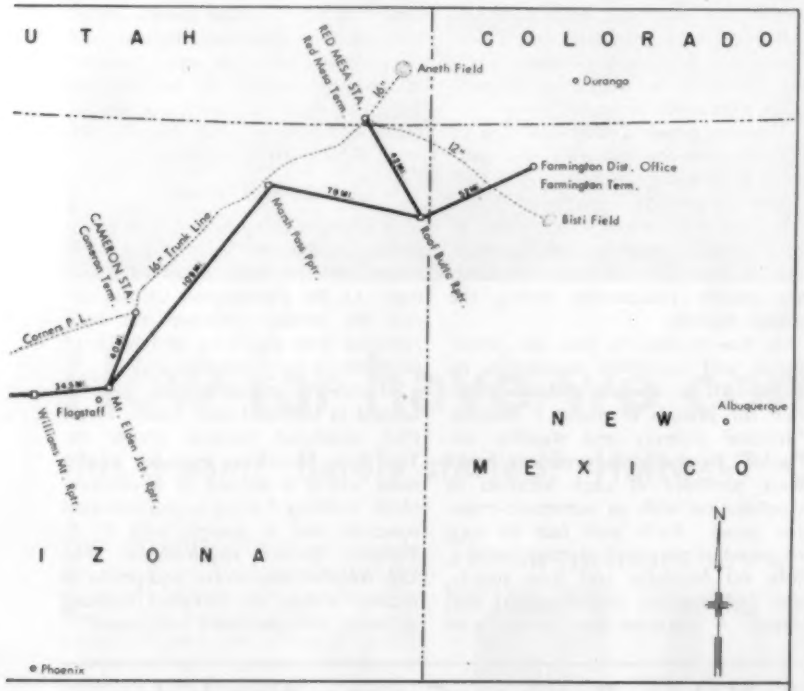
An additional circuit is used to connect the terminal and Farmington with all pump stations, selective dialing being used to signal the desired station and instrument. At the terminal, this circuit appears at the terminal dispatcher's turret for the dispatcher's use, and at the PBX switchboard for connection to telephones within the terminal building.

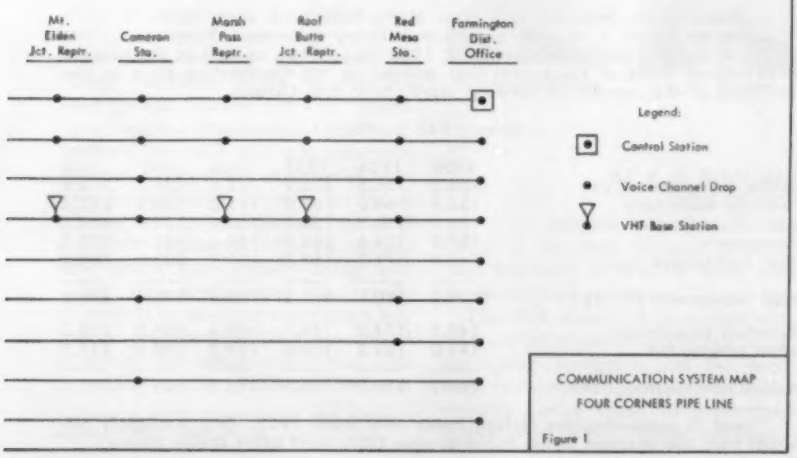
Two voice channels are used to control VHF base stations located at all microwave repeater installations. Base-station antennas are oriented to provide blanket coverage of the trunk and feeder line areas thereby providing an effective communication network between office and field personnel.

Since field personnel fall into two groups geographically, the base stations are similarly divided between the east VHF control channel (No. 4) which will have Farmington as its control point, and the west VHF control channel (No. 5) which will be controlled from Los Angeles. Access to the east control channel can be had from any of the pump stations in the immediate vicinity of the base stations controlled by this channel and to base stations controlled by the west control channel by connecting the two control channels together at either Farmington or Los Angeles.

This latter feature can be accomplished by dialing a proper code to effect the tie followed by the proper code to select the desired base station. Similarly, access to the west control channel can be had from any of the pump stations in the immediate vicinity of base stations controlled by the west control channel and to base stations on the east control channel by using the tie.

Incoming mobile calls will be heard at all pump stations and the control point on the channel controlling the base station(s) receiving the call. The called party must then dial the base station over which he intends to an-





COMMUNICATION SYSTEM MAP
FOUR CORNERS PIPE LINE
Figure 1

swer the incoming call, and the call can then be completed.

The additional voice channels are used in various party-line arrangements to provide for supervisory control, telemetering, and remote-reading tank-gaging signals. A maximum of 35 narrow-band frequency-shift voice-frequency carriers can be transmitted over a single voice channel between 300 and 3,000 c.p.s. Each VH carrier transmitter can be shifted in frequency to either a mark or space frequency. The mark frequency is 12.5 cycles above and the space frequency 12.5 cycles below the channel frequency of 300 c.p.s., while at the 3,000-channel frequency the mark and space frequencies are 25 cycles above and below the channel frequency.

For supervisory control and telemeter signaling, each VH transmitter is arranged to be in "space" frequency condition during no signal input and in "mark" frequency condition when keyed. The associated receiver will reflect simultaneously the condition of its transmitter; the complete absence of an input signal will cause the receiver to remain in "mark" frequency condition thereby providing an alarm function if required.

In the case of the remote-reading tank-gaging circuit, receivers are installed at Los Angeles terminal and Red Mesa pump station with tank-gage field selectors located at Red Mesa, Kingman, and Corona stations. Bidirectional transmission of intelligence is required, and, therefore, two frequencies are used. Each transmitter is arranged to transmit "mark" frequency when at rest and "space" frequency when keyed.

Associated with each transmitter is a party-line keying device which removes its transmitter from the line during "mark" frequency condition. When a transmitter is keyed, the party-line keying device instantly puts the transmitter on the line until a predetermined time following the last impulse. Since the transmitters are normally removed from the circuit on which they operate, all receivers remain in "mark" frequency condition until keyed to "space" frequency by one of transmitters.

In this manner, one of several transmitters can be made to key several receivers operating on frequency shift basis. Since "mark" position is one of rest, no alarm functions are available without incorporating undesirable circuitry.

Voice-frequency carriers for supervisory control and telemeter signals between the Los Angeles terminal and the various pipeline delivery valve stations are transmitted over voice channels leased from the Pacific Telephone & Telegraph Co. Because of the excellent communication facilities in this area, it is not anticipated that any appreciable outages will occur. Business telephones are installed at each of the valve stations to permit maintenance personnel to call the Los Angeles terminal.

Power Sources

Three of the eight mountain-top repeaters are served by commercial power having unusual reliability. Propane-fueled standby engine generators with automatic-transfer panel are installed at each of these three locations to assure continuity of power. The generator room of each microwave building is a tightly constructed room well insulated and equipped with replaceable air filters and a ventilating fan to provide necessary cooling to maintain habitable temperatures within the generator room.

With no power available at five of the mountain-top repeaters, the operation of privately owned engine generators to provide a source of power was the only alternative. This, of course, presented an engineering problem in that four of these locations are usually inaccessible during the winter months.

It was imperative that the power plants and respective accessories be engineered to operate without attention for periods of about 3 months. Identical primary and standby air-cooled diesel-engine generator units were provided at each location in combination with an automatic-transfer panel. Each unit has its own engine-starting panel, starting battery, lube oil regulator and lube supply, and dual primary and secondary fuel filters. A common fuel system with 4 months' capacity is available at each location.

As in the case of the standby units, the generator room is a part of the microwave building (excepting Roof Butte, where two separate buildings are provided), tightly constructed, well insulated and equipped with a continuous-type air filter of adequate capacity to provide clean air for both cooling and aspiration. Thermostatically controlled modulating louvers are provided to recirculate as much cooling air as is needed to maintain habitable temperatures within the generator room.

The Los Angeles terminal tower is a triangular, self-supporting tower of galvanized angle construction designed to comply with the requirements of the Los Angeles County Planning Commission. All other towers are of triangular, nongalvanized tubular steel construction, guyed or self-supporting of required height as indicated in Table 1. Parabolic antennas are of mesh construction and vary in size from 4 ft. to 10 ft. in diameter.

Equipment Housing

Microwave equipment at each pump station is housed in standard steel frame, asbestos clad, insulated buildings. At the Farmington district office the asbestos exterior has been replaced with sheathing and brick to conform to local building code.

Microwave repeater equipment is housed in standard steel frame, metal clad, insulated building except the Tip Top Mountain repeater equipment which is housed in a concrete block building having a prefabricated concrete roof to comply with U. S. Forestry Service requirements. The Los Angeles microwave equipment is located within the terminal building adjacent to supervisory equipment.

Nelson Refinery Construction Index

Appears in the Engineering Section in the first issue each month.
Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.
The Index was explained October 1, 1956 (page 110), as well as the Indexes of Individual Items of Equipment that appear on the Costimating Page in the first issue of the months of January, April, July, and October.

Index (1946 = 100)

	1950	1954	1955	1956	1957	May 1958
Pumps, compressors, etc.	138.2	166.5	172.2	192.0	206.7	213.6
Electrical machinery	134.9	160.0	162.5	175.0	188.9	192.5
Internal-combustion engines	126.0	150.5	153.2	164.0	173.9	178.4
Instruments	127.8	154.6	162.9	182.1	187.4	193.5
Heat exchangers	140.0	171.7	156.8	190.7	203.6	188.4
Misc. equipment average	*126.2	160.7	161.5	180.5	192.1	193.3
Materials component	149.5	174.6	176.1	190.4	201.9	202.5
Labor component	144.0	183.3	189.6	198.2	208.6	217.9
Nelson construction index	146.2	179.8	184.2	195.3	205.9	211.7

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above.

How far have we come toward realizing this dream? Barely started? Halfway? Or almost there?

THE INTRODUCTION of technology into the oil patch emphasized the importance of improving recovery efficiency. We were no longer satisfied merely to open the valves or install pumps and take whatever oil nature provided. We wanted to "engineer" the recovery method and come out with an optimum installation for getting maximum recovery.

However, nothing was known of "how" the fluids in the reservoir existed or the "nature" of their movement—except in speculation and imagination. We still did not recognize connate water, knew nothing of relative permeability, or why so much oil was left in the ground, and had a highly inaccurate idea as to just how much was actually being left.

But the development that really gave birth to reservoir technology was that of proration. While the origin of proration was hectic and it was slow in getting started (between 1890 and 1920) it did not become effective until the early 1930's, 70 years after the Drake well and some 27 years ago.

From a paper presented at the eleventh annual TPRC meeting in Austin, Tex.

These authors say...

BROWNSCOMBE

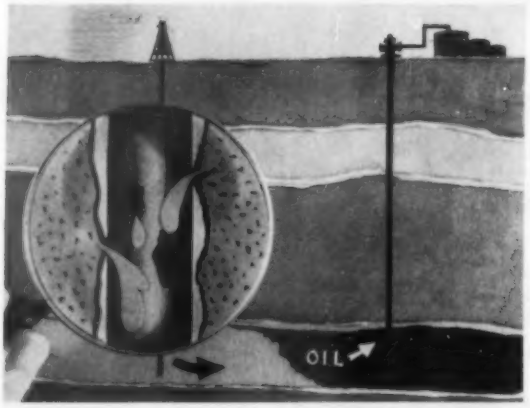
V. E. STEPP

"We think a darn good start has been made in understanding the oil and gas reservoir, but that it is no more than a start. Developments will probably continue to occur at an accelerated rate." This article lists and discusses what the authors believe are some of the more important of these developments.

BY V. E. STEPP AND E. R. BROWNSCOMBE
Atlantic Refining Co., Dallas

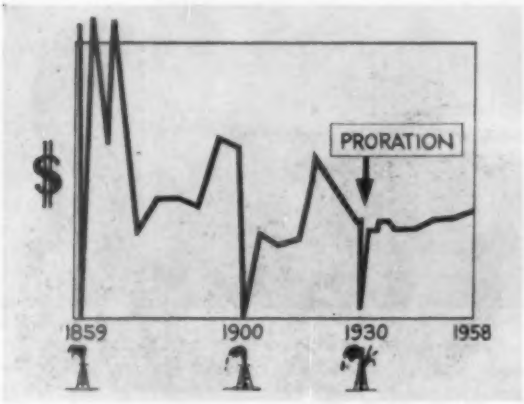
The first efforts at proration were born out of economic needs but would not openly recognize that the needs were economic. Economic chaos had resulted during these 70 years from market instability—"boom and bust." Physical waste accompanied economic waste. The uncomfortable fact that "wastage" must consider economic factors as well as physical factors was shunned.

We knew that oil soaking into earthern pits and escaping down surface streams was waste, but its waste in the reservoir was only in-

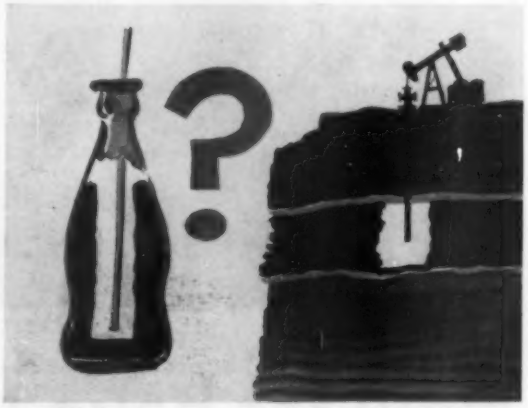


WATER FLOODING—The first water flood occurred accidentally through leaks in the pipe and cement. This was the first method for increasing oil recovery.

PHYSICAL AND ECONOMIC WASTE—Wastage involves both. Proration brought stability and the engineer is bringing understanding of natural laws.



PRICE STABILITY—Proration led to price stability. Stability is essential for engineering new or improved recovery methods. (Prices are adjusted for inflation.)



ANOTHER EARLY QUESTION—How far can a well drain? (This sometimes is even asked today.) Research now shows complete reservoirs are drained.

tuitively felt. Markets were stabilized and we now see that this stability was essential as a prelude to scientific development of knowledge of the oil reservoir. Stability was essential, too, for application of such knowledge. Without it prices would be too variable to permit adequate comparisons of different methods of operation.

The complete recognition that (1) the principles of conservation and of economics are both laws of nature and (2) that economic principles are essential ingredients of conservation has been slow in coming.

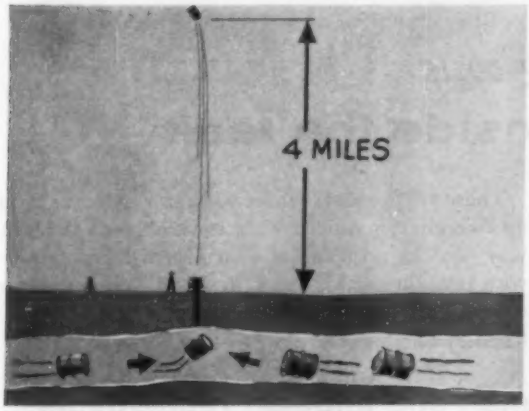
New science demanded . . . In an instant of time, historically speaking, a complete science of reservoir behavior was demanded. An instant before which there was no such scientist and no scientific development, and after which he had to thread his way carefully through the vagaries of popular concept, law, control, and previous intuition. Had such scientific development been available, he could have dealt more easily with the problem of conservation. These first scientists did well with what they had at hand. The curtailment of production was the obvious solution to the economic needs. It was also intuitively felt that efficiency in recovery increased as production rate decreased. Therefore, one of the first ideas of a way to increase recovery was to reduce the production rate—the slower the better. Because rate of decline in reservoir pressure is proportional to production rate, regardless of the type of reservoir, a convenient gage of efficiency was thought to be "bottom-hole" pressure. The idea was that if the rate of decline was reduced, ultimate recovery was increased and reached a maximum if pressure could be held constant. This tied in with the prevalent concept that reservoir energy should be conserved by reducing the rate of flow from the reservoir.

The Energy Concept

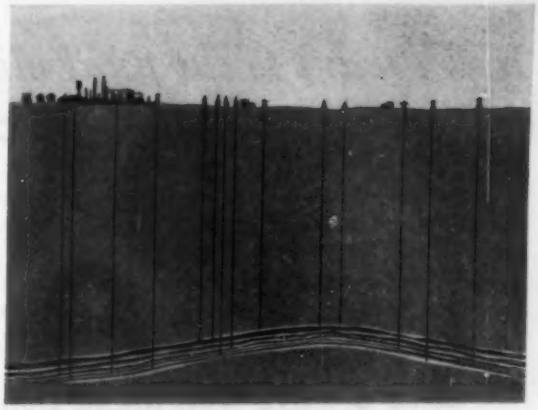
The energy concept was that maximum recovery depended upon maximum ultilization of the energy in the reservoir itself. When it was realized that gas expansion could drive oil out of a reservoir and also that water influx was effective in oil recovery, these effects were thought of in terms of the force required to push oil out of the reservoir into the well bore. Some reasoned that a certain amount of energy was required to move a particle of oil a certain distance and twice as much for twice the distance. It was argued that the energy of these forces should be conserved to get maximum recovery and one way of doing this was to cut back in production rate. It was reasoned that if not used properly this energy would be inefficiently utilized.

If a water drive was present, it was argued that pressure should be kept above the bubble point so that wastage could be avoided by preventing a decrease in the formation volume factor and an increase in the oil viscosity. Adverse effects in formation-volume factor and oil viscosity did occur, of course, but their relation to ultimate recovery was not well understood.

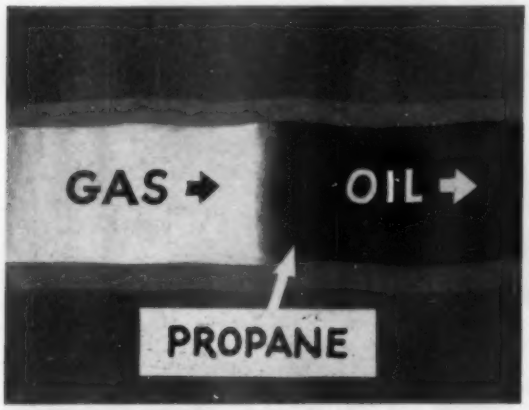
The same idea was applied to reser-



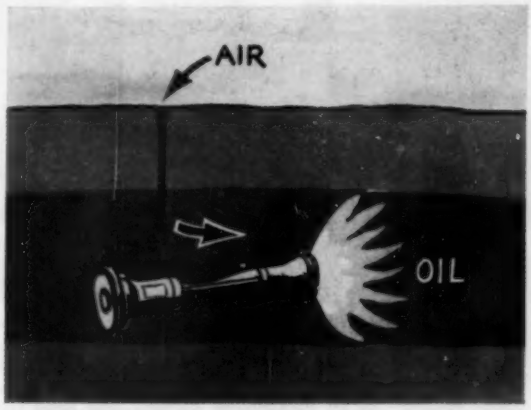
ENERGY CONCEPT—Reservoir energy is not adequate as a criterion for recovery efficiency. Solution-gas drives have large energy but poor recoveries.



"ENGINEERING" THE RECOVERY METHOD—An example is Block 31, Crane County, Texas. Natural recovery would have been very low from the deep, tight reservoir.



PROPANE SLUG PROCESS—Why not inject a slug of LPG miscible both with the driving agent (natural gas) and the oil bank being pushed to the output wells?



IN SITU COMBUSTION—Experimental field trials are in progress. The method seems well adapted to very viscous crude oils (southern Oklahoma, California, etc.).

voirs which had no water drive, Here in a reservoir that had to exhaust its pressure in order to produce, it was reasoned, also, that decreasing the rate of production would conserve energy and increase ultimate recovery. But the relation between rate and conservation of energy or of ultimate recovery was not known. Efforts were made to determine maximum rates which could be attained without reduction of maximum recoveries.

The engineer, in many instances, could make only a furtive reference to cost and economics. It became fashionable to argue how far a well would drain in a reservoir as a means of determining proper spacing. A common question which the engineer had to try to answer or "parry" was "how far can a well drain?" As if it could drain efficiently so far but drainage beyond that would be inefficient. Even today, this question is asked and sometimes the engineer gives an answer—maybe just because it is easier to do so and at least business will proceed if he will give some kind of answer.

But then it was realized that many of the fundamental facts of hydraulics were being overlooked or misapplied, some of which were known even before Drake's well. The petroleum engineer, from his first appearance on the scene, had a great desire to engineer the production from the oil reservoir and was acutely uncomfortable because of the lack of engineering knowledge.

The Birth of Research

Perhaps it was at this point that research was born, insofar as crude-oil production is concerned—research that constituted a serious, orderly and scientific approach toward understanding "what" existed in the reservoir, "how" it existed, and the laws of nature governing the movement of fluids in it.

Studies showed that the energy concept was inadequate as a criterion for selecting the best methods of reservoir operation. For example, a solution gas drive usually has a great deal more energy than is required to move all the oil in the reservoir to the well. In fact, expansion of dissolved gas in a reservoir usually releases much more energy than does the advancing water in a water drive. However, the recovery from the solution gas drive is only a fraction of the recovery from the water drive. That is, the one that releases the most energy has the least recovery. As a matter of fact, getting enough energy is never a problem. And, even if the reservoir were short of energy, there are abundant external sources. This is not to say we would know, however, how to apply it.

The idea of restricting the flow from a solution-gas-drive reservoir to increase its recovery has been shown to be fallacious. It has been shown, also, that water-flood recoveries are highest if the reservoir is produced at a pressure somewhat below the bubble point.

It has become apparent that the key point of recovery from the oil reservoir is the displacement of oil from the rock by some other fluid, such as gas or water. The concept of relative permeability was introduced as a mathematical tool to determine

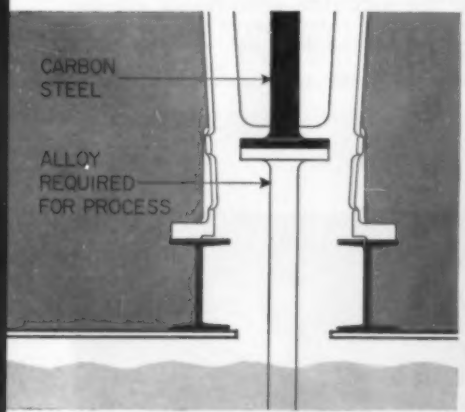
If you want to cut fluid mixing costs
look inside the tank

You can make some of your biggest cost reductions *inside* the tank, when you select a mechanical mixer for fluids.

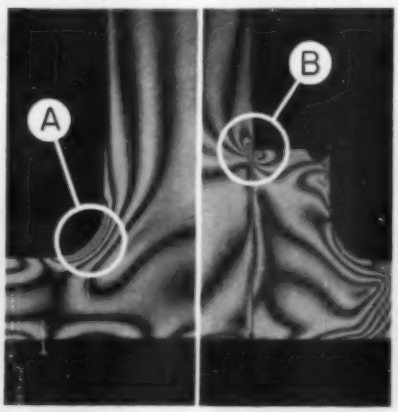
These are *long-term* savings—based on low-cost maintenance, trouble-free service, adaptability to changes in your process, minimum spare-part requirements.

These are the areas where you can *really* save money on fluid mixing. And here are some in-the-tank reasons why you can do it better with LIGHTNIN Mixers than with any other make. For lowest-cost fluid mixing, see your LIGHTNIN representative soon. He's listed in Refinery Catalog. Or write us direct.

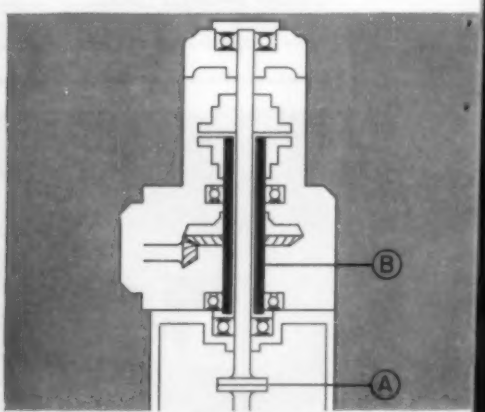
Save 6 ways with these *Lightnin* shaft and impeller refinements



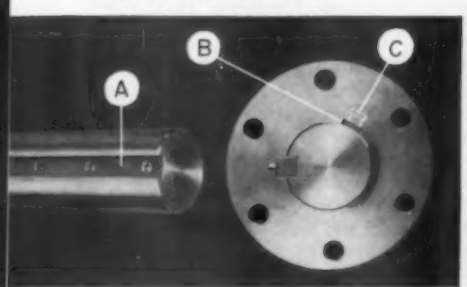
1. Get lower-cost installation, upkeep with two-piece shaft. Standard on open-tank units (available with closed-tank units, too), lower section is alloy required for process; upper section can be inexpensive carbon steel. Rigid coupling has rabbeted joint assuring accurate alignment.



2. You get twice the strength of conventional shaft couplings with LIGHTNIN deep-welded coupling (A). Not one of these couplings has ever failed in service. Polarized light shows how machined and polished radius eliminates stress concentration found in conventional coupling (B).

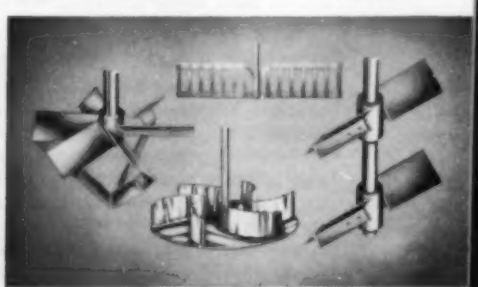


3. No need to disturb gearing if you ever want to replace a LIGHTNIN shaft. Lower shaft is unbolted at (A). Upper shaft slides out of hollow reducer quill* (B). Gears remain untouched—cannot get out of line. When new shaft is installed, shaft alignment is automatic. *Patented



4. Save time positioning impellers. Standard 18-inch shaft keyway (A) provides seven positions (more if you want)—saves you cost of special machining. Also note shallow extra keyway (B) for impeller hub setscrew (C). It permits impeller to slide freely, even if shaft is burred.

5. Cut impeller replacement cost with LIGHTNIN all-bolted design. Replace blades without buying a whole new impeller. Blades come off to pass small openings; or impeller can be supplied split, as shown. Same disc takes 4, 5, 6, or 8 blades for easy change in power input.



6. Get the right impeller for your needs. You can handle practically any fluid mixing requirement with a standard LIGHTNIN impeller. But for special jobs, you can get LIGHTNIN impellers made to specification in all machinable materials and with widest choice of coverings.

WHAT MIXING OPERATIONS ARE IMPORTANT TO YOU? You'll find a wealth of information on fluid mixing in these helpful bulletins describing LIGHTNIN Mixers:

- ☐ Top or bottom entering; turbine, paddle, and propeller types: 1 to 500 HP (B-102)
- ☐ Top entering; propeller types: ¼ to 3 HP (B-103)
- ☐ Portable: ⅛ to 3 HP (B-108)
- ☐ Confidential data sheet for figuring your mixer requirements (B-107)
- ☐ Side entering: 1 to 25 HP (B-104)
- ☐ Laboratory and small-batch production types (B-112)
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Check, clip and mail with your name, title, company address to:

MIXING EQUIPMENT Co., Inc., 174-J Mt. Read Blvd., Rochester 3, N.Y.

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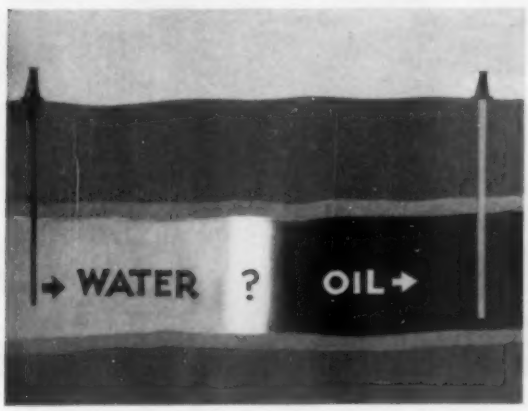
Lightnin® Mixers™

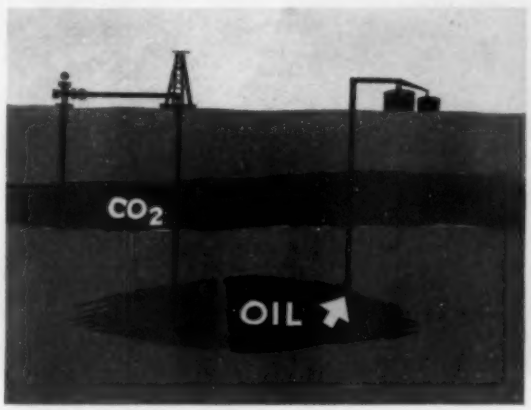
MIXCO fluid mixing specialists

WETTABILITY OF OIL PAY—Failure to account properly may lead to errors in determining efficiency with which water will displace oil in the reservoir.

SURFACE-ACTIVE AGENTS—Increased understanding of wettability and effect of surface forces may lead to higher flooding recoveries through surface-active agents.



NEW ADDITIVE NEEDED—Water drive has highest sweepout efficiency. Need an inexpensive material (some of the alcohols?) miscible in both oil and water.



CARBON DIOXIDE GAS?—It lies between propane and ethane in its behavior as a displacing agent. Ideal would be having a CO_2 reservoir near an oil pay.

the displacement of oil to be expected under various conditions.

The injection of gas or water into a reservoir after it had exhausted itself by natural means gave rise to the terms primary recovery and secondary recovery. The depletion of oil reserves were thought of as occurring in two stages: first the primary, next the secondary. The use of water flood in Bradford probably led to this way of thinking.

The engineer was not too pleased with the fact that sometimes secondary recovery applications were held in abeyance because he was not to be trusted with the possibility of causing harm to primary recovery. After primary recovery what did one have to lose? Of course, today, while the terms of primary and secondary are still used, they do not denote the timing of the operation. Many so-called secondary recovery applications are applied near the beginning of production and the reservoir does not have to go through a primary recovery phase.

Early estimates of displacement by water for a five-spot well pattern indicated a sweepout pattern efficiency of 72% at time of water breakthrough. Seventy-two per cent, or some figure close to it, was used for the ultimate pattern efficiency. Actually, water usually sweeps out essentially 100% of the reservoir area even in fairly adverse well patterns. Although the water is very effective in reaching all parts of the reservoir, it only displaces about half the oil from the reservoir rock it touches, the other half being left behind as a residual oil.

Because of its low cost and its high areal sweepout efficiency, water flooding has been very successfully used not only in shallow reservoirs, but also in deeper reservoirs. Moreover, its high sweepout efficiency makes it a useful tool in limestone reservoirs which were previously thought to be too inhomogeneous to permit water flooding.

Miscible Displacement

When the drill began to penetrate 6,000 to 8,000 ft., the produced gases became richer and it was found that condensate could be obtained from wellhead bases merely by dropping their pressure. This surprising phenomenon of retrograde condensation was observed in the field before it was realized that it was a well-known effect in the laboratory. Field tests were undertaken to determine recoveries and the optimum operating conditions. For example, in 1938, Atlantic set up a pilot plant at Palacios, Tex., to study the optimum method of recovering condensate from this high-pressure gas field.

Block 31 . . . A case history of "engineering" the recovery method to determine the optimum method of obtaining maximum recovery is that of Block 31 field, Crane County, Texas. It was apparent soon after its discovery in 1945 that the recovery would be very low. This is a deep, tight reservoir. Some program was necessary to augment natural recovery, and the sooner the better.

Upon being informed of this and that pressure would decline very rapidly, our management didn't even wait for the technologists to work out the

DOWELL'S 41 ACID ADDITIVES

DOWELL ENGINEERS USE THESE ADDITION AGENTS TO TAILOR ACID TREATMENTS TO THE REQUIREMENTS OF YOUR WELL

Each of the bottles shown here contains a chemical especially selected by Dowell to overcome certain formation peculiarities encountered in acidizing oil and gas wells.

Mere stores of chemicals mean little, however. They must be blended and used skillfully. Dowell engineers and chemists apply unparalleled experience in recommending these addition agents to speed up payout and increase ultimate recovery from your wells.

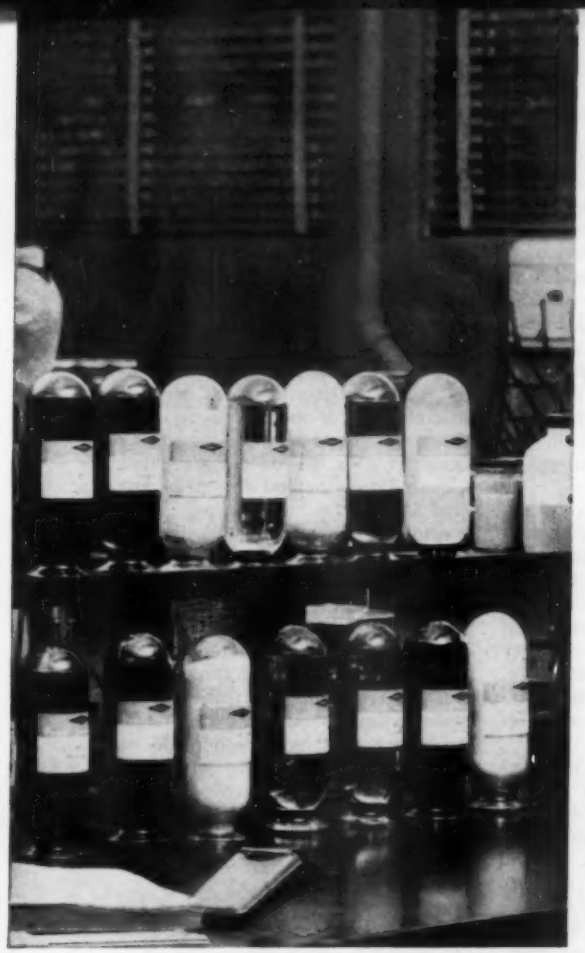
Dowell scientists are not satisfied with a single agent for a purpose. Since well conditions vary, they have developed *families* of agents to do each job.

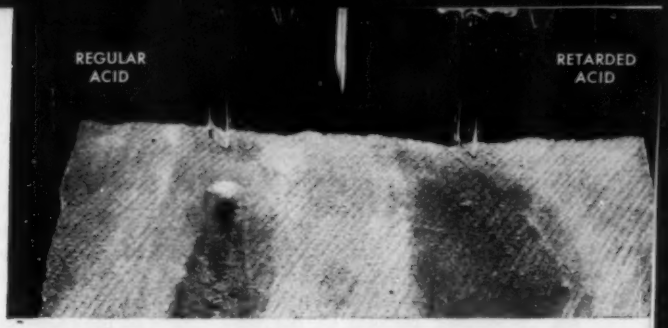
When faced with a problem well, Dowell chemical and petroleum engineers, aided by the most modern laboratory equipment, analyze the problem. If necessary, they employ an electronic IBM system to help identify well samples and select the right addition agents. This complex system, developed by The Dow Chemical Company, is continually added to and modified—to provide you fast, effective analytical service.

On these pages, you will find four examples of Dowell addition agents and how they work. For full information on "tailored" acidizing, call any of the 165 Dowell service points. In Canada, contact Dowell of Canada, Ltd.; in Venezuela, contact United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

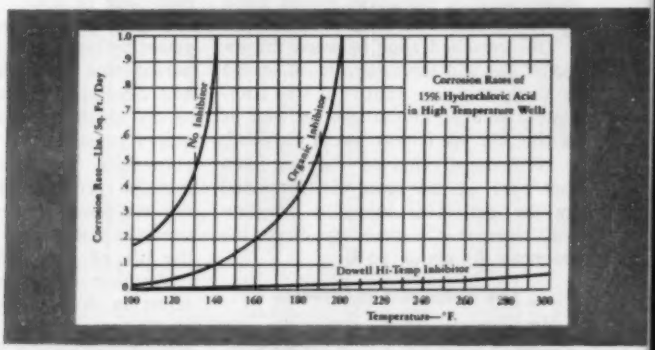
Services for the oil industry DOWELL

A SERVICE DIVISION OF THE DOW CHEMICAL COMPANY





THE PETTIT FORMATION in East Texas and North Louisiana is an oolitic limestone, and a good example of a formation that responds favorably to Dowell Retarded Acid. This photograph shows the slower reaction rate of Retarded Acid (right) as compared to that of regular inhibited acid. The retarded action often results in higher production and faster payout.



THE USE OF an effective acid inhibitor is as important as the selection of the proper addition agent. For that reason Dowell research has developed a variety of inhibitors. Most famous of these is Dowell's high temperature inhibitor — proved effective in wells with bottom-hole temperatures up to 350° F.

GIVE YOU A FASTER PAYOUT

SILICATES WITHIN the Strawn sand as found in Nolan County, North Texas, swell seriously when treated with regular inhibited hydrochloric acid. This frequently restricts production. When Dowell silicate control additive is blended with the acid, silicate swelling is reduced, as shown here. Good production increases are the rule in this area when Dowell tailors the acid treatment to control silicate swelling.

MUD ACID OFFERS different benefits to different producers. Along the Gulf Coast, operators order it for its excellent mud-removing qualities. In the Permian Basin, the Rockies, and Canada, it is valuable to spearhead fracturing, acidizing, or cementing operations. It is also useful to acidize certain sand formations of low regular acid solubility. In *all* areas it helps improve the results of Dowell stimulation treatments.

best method of recovery. They very early instituted a program of returning all of the solution gas to the reservoir. This program increased the estimated recovery from about 20% to about 35%.

In the meantime, efforts were under way to determine the optimum method of recovery. Water flooding would not be suitable because of the very low permeability. Earlier studies of retrograde condensation had indicated that enriched gas would be a useful agent in displacing black oil. As further work was carried on, it was finally realized that natural gas injected at high pressures would build up to an enriched zone at the front.

This enriched zone between the injected gas and the reservoir oil served as a miscible slug; that is, it was completely soluble in the gas as well as in the oil. As it was swept forward, it completely removed the oil from that part of the reservoir contacted by the gas. This injection program will increase the recovery from the reservoir to about 65%.

The Propane-Slug Process

When it was realized that the efficiency of displacement of oil by high-pressure gas was due to the presence of an enriched zone miscible with both the oil and the gas, a new idea developed. Why not inject a slug of some material which would be miscible with the oil and the gas? Wouldn't it behave just like the enriched zone built up with high-pressure gas injection? The slug would have the further advantage that it might be miscible at a lower pressure than is the enriched zone referred to above.

This led to the idea of using a slug of propane followed by gas as a displacing agent. Pressure conditions are maintained such that the gas behind the propane is miscible with the propane and therefore displaces it with essentially 100% efficiency. No propane is left as a residual phase behind the frontal advance of the gas.

Likewise, of course, the propane is miscible with the reservoir oil and sweeps it out efficiently ahead of the propane. This minimizes contamination of the propane slug by the reservoir oil. Thus a small slug of propane can be pushed through the entire reservoir. The requirement for a high content of LPG and natural gasoline in the reservoir oil is eliminated.

The simple propane-slug process recovers essentially 100% of the oil from the part of the reservoir it contacts but unfortunately, the areal sweepout pattern is poor. Only about half of the reservoir is contacted. Thus, its over-all recovery is about like that for water flooding.

The question naturally arises then: Is there anything we can do to combine the high displacing efficiency of propane with the high sweepout efficiency of water flooding? We believe the answer lies in the concurrent use of water and gas injection following a propane slug. The water serves to push the gas and propane into all parts of the reservoir. This, of course, requires close control of the amounts of water and gas injected because if the water advances into the propane without a buffer zone of gas, then propane will be left behind in the water as a residual phase and miscibility will be lost.

Such a process requires careful engineering because it would not be apparent that difficulties of this type had developed until it was too late to do anything about it. It also requires consideration in the setting of allowables. The increase in recovery must be recognized because otherwise, it is not possible to make the large inventments that are required early in the life of a project.

Another development of wide interest in driving toward the goal of maximum recovery is that of underground combustion. Experimental field trials are in progress. This method seems to be well adapted to very viscous crude oils. Articles that we have read indicate that the amounts of compressed air required to maintain combustion are excessive from an economic viewpoint. We know that several companies are actually working on improving this process and it is hoped that new developments will make this a practical tool.

Looking Ahead

Where are we now in our understanding of the oil reservoir—of how the fluids exist, what these fluids are, and the nature of fluid movement? How well along are we toward attaining maximum recovery—barely started, halfway, or almost "have it made"?

We think a darn good start has been made in understanding the oil and gas reservoir, but that it is no more than a start. Looking back, it is surprising how long it takes after all of the basic data are available and all of the concepts have been developed, to put two and two together and come out with an obvious improvement in a process. Developments will probably continue to occur at an accelerated rate. What might these developments be?

One of the important areas of knowledge about the reservoir that is still inadequate is that pertaining to the wettability of the rock. Failure to take this factor properly into account may lead to errors in determining the efficiency with which water will displace oil in the reservoir. As an extreme example, recently we made an estimate of recovery for a reservoir on the basis of conventional methods and then found by applying some of the new techniques (taking wettability into account more carefully), the recovery by water flooding would be about twice what we had estimated. Such a difference can be very important when making a choice between different ways of operating a reservoir. Much remains to be done concerning wettability. We still do not even have a quantitative method for measuring what it is.

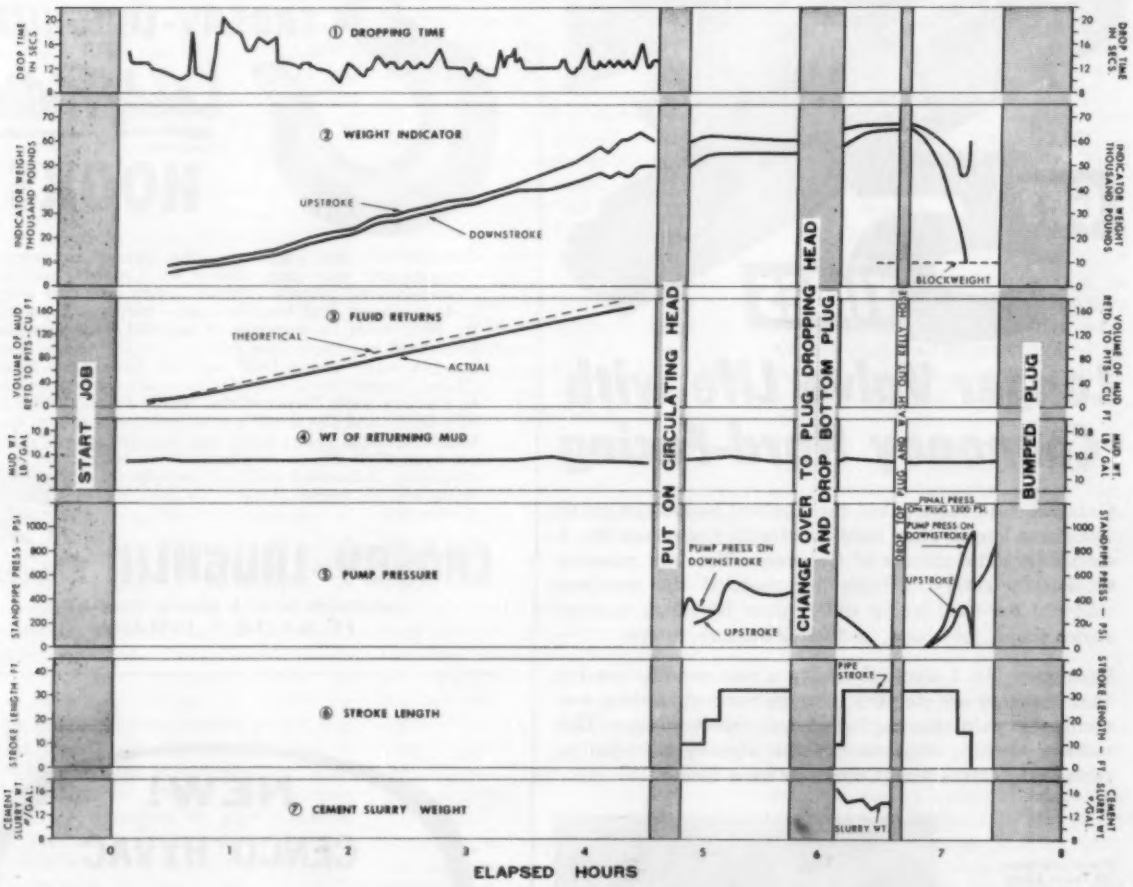
Another important knowledge deficiency concerns surface forces which are related to wettability. We all know that soapy water does a much better job at washing oil out of clothes than does plain water. It is natural to expect that the use of wetting agents of some type will be effective in increasing the recovery by water flooding. Many tests have been made on this but so far the results have been disappointing. An increased understanding of wettability and the effect of surface forces may lead to higher recovery by water flooding with the use of surface active agents.

Another place where we need improved technology is in understanding reservoir inhomogeneities, such as fractures and stratification. We need a better idea of what types of inhomogeneities are present in reservoirs and how they affect injection operations. Some progress has been made but much remains to be done.

In view of the high sweepout efficiency of water, one development that would be of great importance would be to find an inexpensive material which is miscible with both oil and water. Such material could then be used much as the propane slug is. Some materials are known which will work in this direction; for example, some of the alcohols. But they are too expensive.

Another material that is of interest in certain circumstances is carbon dioxide. It lies somewhere between propane and ethane in its behavior as a displacing agent. If a large amount of carbon dioxide were available at some location in one horizon, it might be very useful in displacing oil from another horizon.

One cannot think of possible achievements in reaching maximum oil recovery without thinking also of the effects of such things as shale oil, tar sands, foreign imports, governmental developments, and other factors. All these things will influence technical developments.



These data from a Saskatchewan well illustrate method of

Analyzing cementing problems

BY E. H. CLARKE, JR., AND A. S. MURRAY

THE IMPORTANCE of the correct application of cementing procedure was covered in Part 1 of this series (OGJ, August 25) Part 3, which will appear later, will recommend casing running procedures, and will cover shale disintegration as it effects cementing operations.

E. H. Clarke, Jr., is with Baker Oil Tools, Inc., Los Angeles, and A. S. Murray is with Imperial Oil, Ltd., Calgary, Alta. Paper presented at API production division meeting, Los Angeles, 1958, under original title, "A Study of Primary Cementing." Part 1 ran in the August 25 issue of The Oil and Gas Journal, and Part 3 will appear in the September 8 issue.

Casing Stuck

Prior to the completion of the cementing job on this particular well, the casing stuck, due to cement dehydration. The need for corrective measures was apparent.

Background information . . . Three centralizers and 24 scratchers were placed over the bottom 340 ft. of the 7-in. 23-lb. casing which was to be landed at 3,850 ft. in a 9-in. hole. Floating equipment was used. The gyp-starch mud weighed 10 lb. per gal. had a Marsh funnel viscosity of 54 seconds, a yield point of 34 lb. per 100 sq. ft., a plastic viscosity of 14 cp., and a water loss of 8 cc.

The formation in this area was fairly permeable and wall-cake deposits were evident on a number of the last bits pulled from the hole. A minor case of lost circulation had been noted

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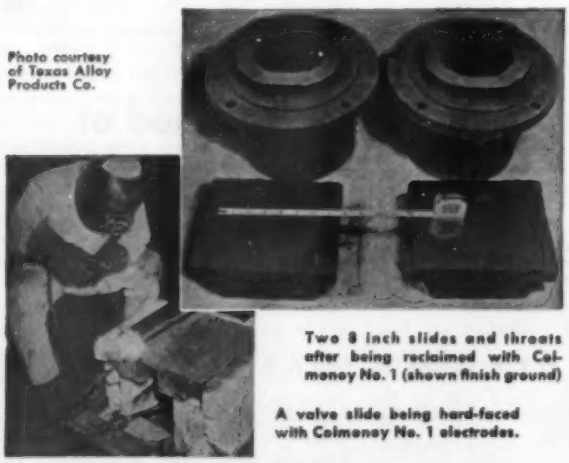
Photo courtesy of Texas Alloy Products Co.



Two 8 inch slides and throats after being reclaimed with Colmonoy No. 1 (shown finish ground)

A valve slide being hard-faced with Colmonoy No. 1 electrodes.

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when conditioning for logging and testing but this cleared up without remedial steps.

Running casing . . . The only change made is running procedure was to increase the frequency of filling the casing for more accurate fluid measurement. This was done every 5 joints instead of the usual 10. As the job progressed, detailed information on hole condition aided evaluation of running technique. This is shown in Curves 1, 2, 3, and 4 of Fig. 1. Dropping time for each Range 2 joint of casing (Curve 1) varied initially, but finally averaged 12 seconds. Pressure surges were apparently absent at this dropping rate because mud overflow was almost identical with the theoretical overflow indicating no loss of fluid to the formation (Curve 3).

Observation at the shale shaker indicated that control of casing was effective in preventing shale from sloughing.

The weight indicator showed pipe was free during the initial portion of the trip in the hole. There was little difference between up and down weights (Curve 2). A marked increase in pipe friction was evident, however, after entering the permeable lower sections. This seemed to increase as more of the pay section was penetrated. Although not shown on the curves, it was possible to tell that this increase in friction was due to hydraulic rather than mechanical drag. If mechanical, the greatest friction generally occurs as the pipe is started in motion, and the loss or gain of weight is not too sensitive to the speed of the pipe.

Pipe weight becomes quite sensitive to dropping rate when hydraulic friction causes the drag since this is a function of the square of pipe velocity. Pipe weight, in this case, was very velocity-sensitive, and it was felt that the hole was being reduced in the lower section by growth.

Circulating and cleaning hole . . . Circulation was established on reaching bottom with the pump running slowly and the pipe in an upward motion to minimize pressure. Initially, there was 100-psi. difference in the pump pressure on the upstroke and downstroke of the casing (Curve 5). When scratchers became effective on increasing the stroke length to 20 ft. (Curve 6), friction decreased and the pressure differential dropped to zero. At this point the pump was speeded up to normal capacity and the stroke length was increased to one full joint.

Effective weight of the mud (which includes the basic mud weight plus the weight of suspended shale particles) increased only slightly during the cleaning period as returns came from bottom. Very little shale was recovered. It should be pointed out that the efficiency of scratchers and centralizers cannot be measured by the amount of shale which comes back over the shaker. Correctly placed, they will not cause a hole to load with shale cuttings resulting from mechanical abraiding. No scratcher is stiff enough to dig solid shale from the walls of the hole. It is possible to have shale embedded in very heavy mud cake in such a manner that it would be circulated out when mud cake rather than shale is loosened. Clean shale particles have probably been removed from the wall of the hole by pressure surges or chemical action.

There was no change in hole condition at the end of 45 minutes so preparations were made for mixing cement.

Mixing cement . . . Measurement of slurry weight taken during mixing operations (Curve 7) showed that the first portion of cement had been mixed somewhat heavy and dry. This was corrected later. Standpipe pressure dropped as heavy cement was displaced into the casing (Curve 5). Casing-string weight increased on both the upstroke and downstroke of the pipe. When the disk in the bottom plug ruptured the standpipe pressure went up to 200 psi. and then dropped back to zero.

Displacing the cement . . . Casing friction increased as the cement was displaced in the annulus under laminar-flow conditions (service-company pump). When standpipe pressure became measurable, it was noted that pressure was being lost on the pipe upstroke and gained on the downstroke. Pipe friction increased from 3,000 lb. to 19,000 lb. as displacement continued. The spread in standpipe pressure increased until there was a 400 to 500-psi. difference between the upstroke and the downstroke. The displacement pump became overloaded. It was obvious that the casing was going to stick. Reciprocation was shortened to 15 ft. but not stopped since it was unimportant to land the casing on bottom.

Pipe drag eventually reached 38,000 lb., which was only 2,000 lb. above the weight of the casing (due to increased buoyancy while displacing with water). Standpipe pressure was actually going on a vacuum when the pipe was pulled up. Further readings could not be taken so the brake was released. The pipe hesitated for 3 or 4 seconds and then settled to bottom. Displacement was continued with no further reciprocation until the plug bumped.

Causes of difficulty . . . Four per cent gel cement was used on this job. Principal causes of difficulty were:

1. The first portion of the slurry was mixed with insufficient water (Curve 7—Slurry Weight).
2. A high-water-loss cement was used (approximately 200 cc. API).
3. Cement was displaced at low rate using the cement-truck pump. (laminar flow).

The danger signal was the increased hydraulic drag on the casing as it penetrated the permeable section. A thick filter cake had been formed here by the low-water-loss gyp-starch mud. As this mud was largely replaced by the high-water-loss cement, acceleration of the filtering action was inevitable.

Casing strings do not stick without warning (unless the casing string is left stationary where the operator cannot see what is happening). It was apparent that this string was getting sticky at least 15 minutes before it froze. There was definite evidence that it would stick 8 minutes before it actually did.

Corrective measures . . . This problem could have been prevented by displacing cement more rapidly (rig pump) and by using mud instead of water to reduce pump horsepower. Hydraulic scouring action is intensified by rapid displacement. This might have helped to keep the annulus open. Low-water-loss cements may have reduced or eliminated the problem but this was hardly justified on such a shallow well. Correct mixing of the first portion of the slurry or overwatering in anticipation of water-loss conditions could have reduced the problem to minor proportions.

Production analysis . . . These records showed that the well would probably produce in a normal manner, because over 60% of the cement was outside the casing before reciprocation was stopped. The only commercial production was opposite the second joint off bottom where cement was thoroughly "scratched in" and bonded. A summary of the production from this well confirmed this since it showed rates and quality in excess of expected values.

The study method illustrated here can be invaluable not only to the solution of operating problems but also as an educational tool to acquaint personnel with the complex nature of primary-cementing jobs.

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Great Lakes employes learn about

Fire fighting

Going . . .

Going . . .

GONE!

PROPER WAYS to put out a fire are taught Great Lakes Pipe Line Co. supervisors at a special fire-fighting school conducted by Ansul Chemical Co. The supervisors received special instruction in problems dealing with product pipelines.

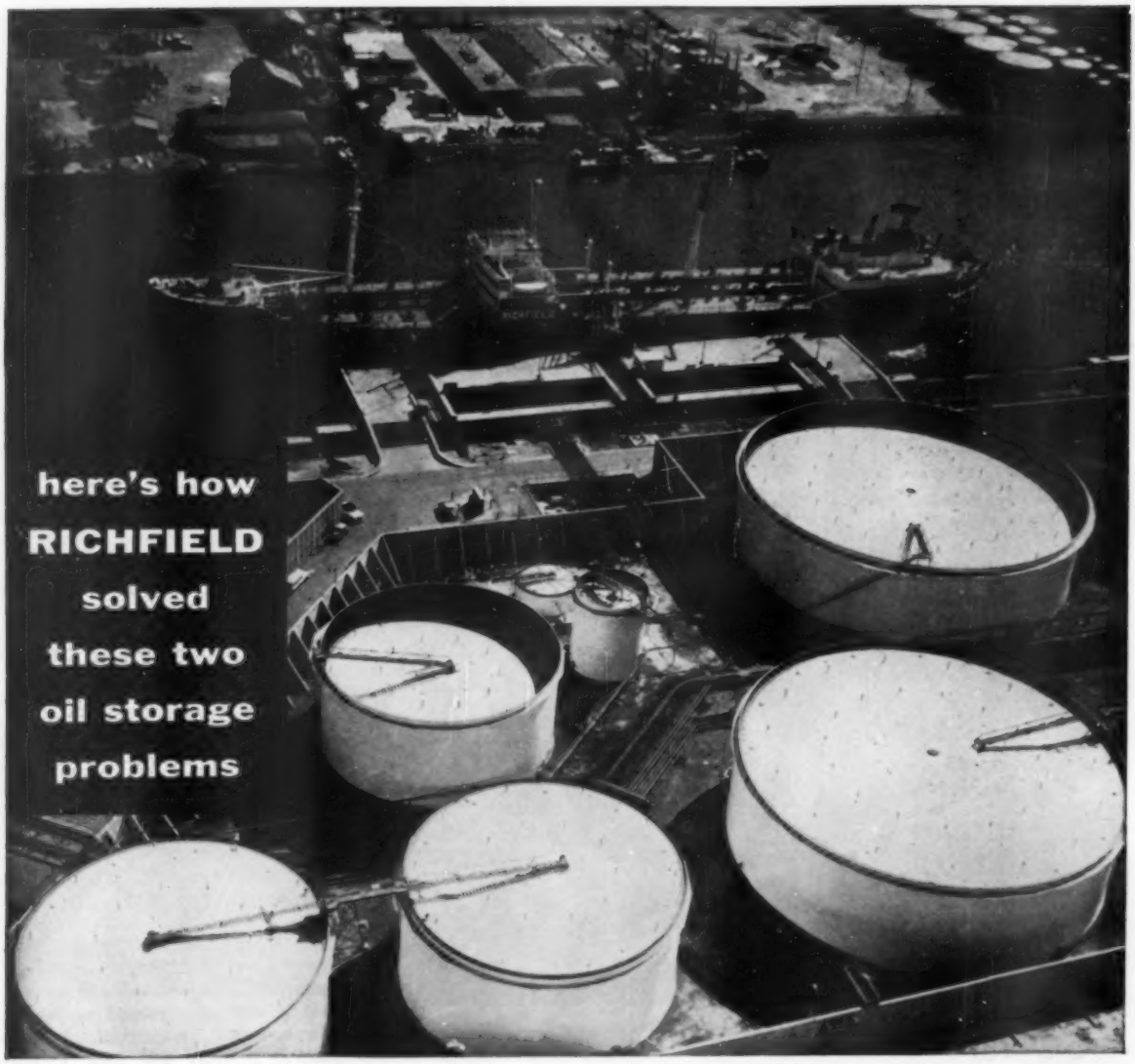
FIRE has become a rare occurrence on a well-run pipeline, even on systems handling gasoline and liquefied petroleum gases. Increased knowledge of fire hazards has resulted in safe designs and practices which almost eliminate fires.

Fire extinguishers are located strategically at all stations and terminals. The most important step remaining is to prepare personnel to handle the infrequent fire that does happen.

Great Lakes Pipe Line Co. recently sent 28 supervisors to a fire-fighting school conducted by Ansul Chemical Co., a manufacturer of dry-chemical fire-extinguishing equipment, in Marinette, Wis. The Great Lakes contingent filled the entire enrollment, so the instruction could be centered on the special problems confronting products pipelines, whose greatest hazards are at terminal loading racks.

The supervisors spent 3 days listening to lectures, watching films, and dousing fires created to simulate situations most likely to occur. Most of the time they were actually fighting fires. They used 150 and 350-lb. wheeled and 20-lb. hand-portable dry-chemical extinguishers to put out fires in broken overhead piping and other vertical, horizontal, and impinging gasoline and LPG pressure fires. The stream of dry chemical driven by pressure from gas cartridges releases carbon dioxide and water vapor upon entering the flame and reduces the air (oxygen) supply within the fire to a point that will no longer support combustion. Each trainee at the school is accompanied by an instructor who is at his side as a precaution and also for coaching. Each one works through the entire range of fires to gain the widest possible experience.

Fire-fighting methods . . . When the trainee is faced with fire from broken piping, he is taught to concentrate on putting out the fire at the break first. Then he will extinguish the burning fuel which has spilled to the floor or ground. In pressure jet fires, he directs the chemical through the point of combustion and into the fire itself. Thus, in a burning horizontal



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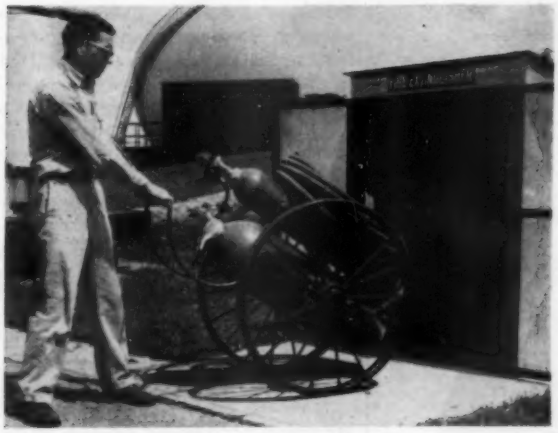
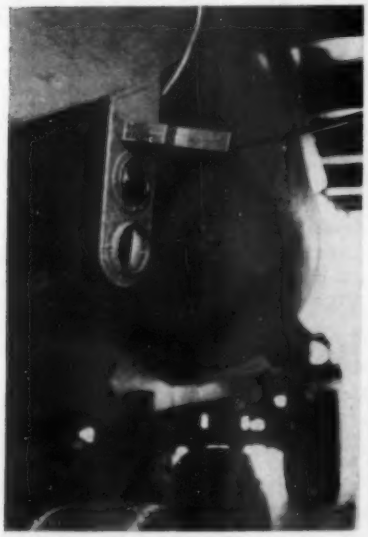


INSTRUCTION was given in use of these heavy wheeled fire extinguishers.

jet, he would station himself directly behind the jet, if possible, and mingle the dry chemical stream with the stream of fuel.

In multilevel fires, trainees are instructed to put out the fire at the farthest point first and work back to the source. For instance, if gasoline had spilled from a tank truck and caught fire while loading, the burning spill on the ground would be extinguished first. Then the dry chemical stream would be moved up the side of the truck extinguishing the flames last at the source of the fire.

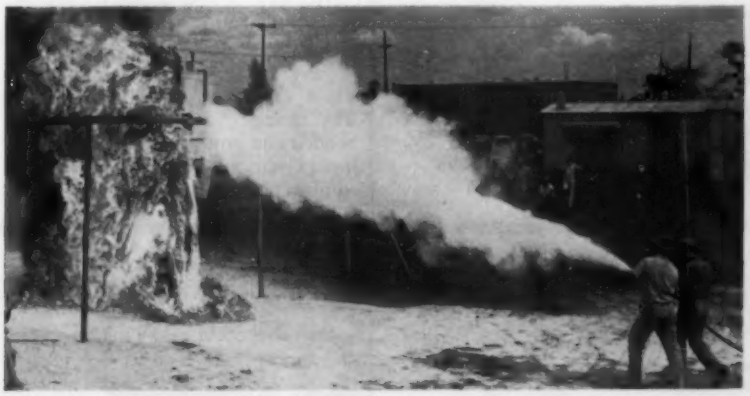


TRUCKS, rack, and piping at the truck rack are bonded and grounded to guard against static electricity.

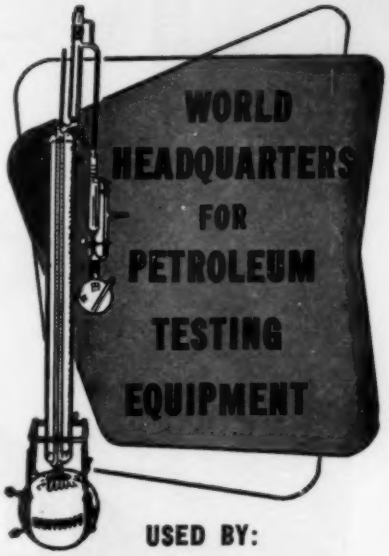
Some fires are "two-man" fires. On these trainees are shown how to work together. An example is a truck fire with 200 gal. of gasoline spilled around the vehicle. Each one takes the hoseline from a 1,000-lb. stationary extinguisher and approaches the fire from upwind.

They begin discharging dry chemical into the near edge of the fire, then split to take opposite sides, pushing the flames back to the downwind side. They must reach all the flames and get around metal obstacles to be successful. When the flames are out, they will stand by ready for flashbacks until the metal has cooled below the ignition point of the gasoline.

Great Lakes program . . . The advanced training received by the supervisors at the Ansul school supplements



FIRE FIGHTERS learn to approach fires from upwind, and begin extinguishing operations at definite points, depending upon the type of fire encountered.



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the regular Great Lakes training program. Demonstrations using fire-fighting equipment are conducted regularly throughout the system. Training is carried out locally and also by the company safety department which offers instruction and demonstration in special problems.

The equipment described previously is available at all Great Lakes installations. Also, at least one 2,000-lb. extinguisher is found at terminals. One to three hoses are connected to the large units protecting truck racks. Extinguishers and hoses are spotted so that a fire may be attacked from different positions.

Even the small 20-lb. extinguishers are potent fire-fighting weapons in the hands of a trained man. It's estimated they can handle a fire covering up to 50 sq. ft. Besides being located at stations and terminals, hand extinguishers are carried by gangs and line patrols.

The small extinguishers are an important part of Great Lakes' fire-fighting program. The idea is to give immediate attention to minor fires in early stages before they become major. An example of their effectiveness is the time a floating-roof tank—considered virtually fireproof—was set fire by lightning at the Kansas City terminal. The blaze was quickly doused by a hand extinguisher. The dry-chemical type is used because of its effectiveness on large oil and gas fires.

Great Lakes has never had a fire in a cone-roof tank. The vapor spaces in fixed cone-roof tanks in gasoline service are manifolded to variable-volume vapor-space tanks. This keeps the mixture in the vapor space too rich to ignite. The vents on fixed-roof tanks are protected by flame arresters, which are also installed on vapor lines to prevent fire from spreading from one tank to another. Fire walls around tanks would confine any product spilled if the tank ruptured.

The key to fire prevention at the most vulnerable spot—the truck rack—is to prevent the introduction of any ignition source to the area where vapors are expelled in loading. The trucks, rack, and piping are bonded and grounded to guard against static electricity. Motors and electrical equipment on trucks are turned off while loading. Explosionproof electrical motors and lights provide further safety insurance. An obvious precaution—prohibition against smoking—is observed.

But if all these safety measures fail, and fire does occur, then Great Lakes intends to be ready to cope with the emergency with a minimum of product loss, property damage, and danger.

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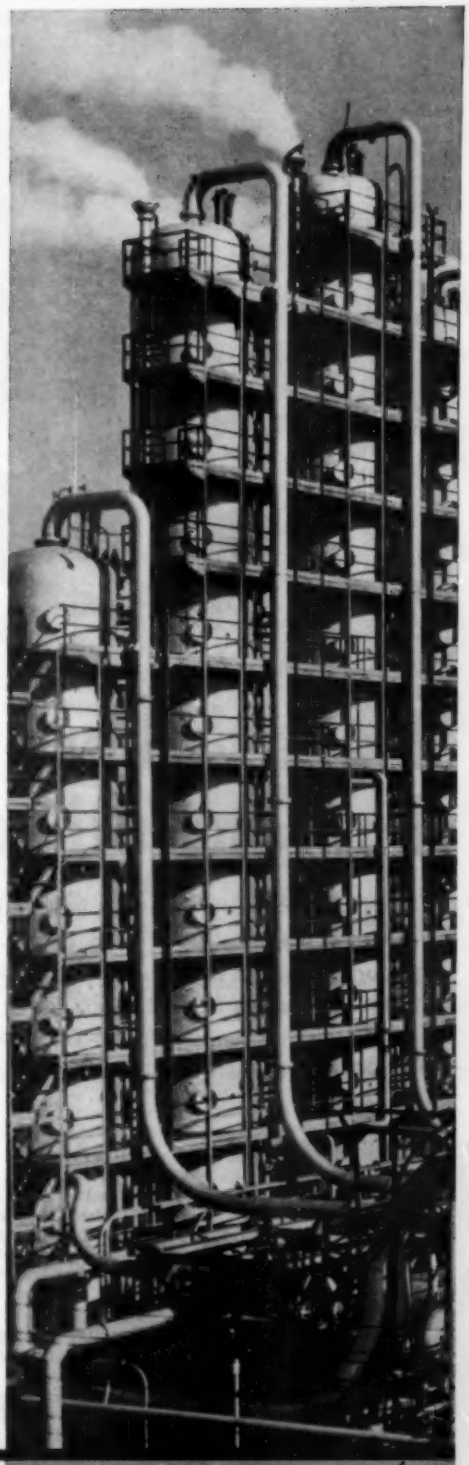

Steaming and washing a 90 foot tower just to remove gas normally took two to three days at one refinery. Labor crews then brushed and scraped for several more days to strip a heavy, crusty deposit from walls, pans, downcomers and 36 trays. Cost of manual labor alone exceeded $2,800.

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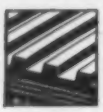

1. Stabilizing ribbed tops (U.S. Pat. 2548135) are exclusive with Gates. They dampen vibration, protect top of belt from damage, keep belt running smoothly over idler-equipped mud pump drives with no side whip.

2. Flex-Weave Cover (U.S. Pat. 2519590) A Gates exclusive: provides greater flexibility with far less stress on fabric. Cover wears longer . . . increases belt life . . . more power available to driven machine.

3. Concave sidewalls (U.S. Pat. 1813698) Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt . . . far longer belt life.

4. Tougher, more resilient cords are able to absorb the severe pulsations of mud pumps; easily handle peak loads.

TPA 300A

The Mark of Specialized Research

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Gates Rib-Top Vulco Rope

DEVELOPED ESPECIALLY FOR MUD PUMP DRIVES

▶ ▶ ▶ Among the Drilling Contractors

H. B. HARKINS RAY BUTLER

GEORGE STANDARD WILBUR-STEEN

Personnel changes made by Texas' Harkins & Co.

RECENT CHANGES in key operating lineup of Harkins & Co., Alice, Tex., contract drilling and producing firm, place Ray Butler, production superintendent, in the new position of superintendent of both drilling and production, and Wilbur T. Steen, formerly tool pusher, as assistant to Butler.

In the capacity of drilling superintendent, Butler succeeds George Standard, who is retiring from the company on the advice of physicians. He has been with the company, formed in 1956, and its predecessor organization (Kirkwood & Co.) 3½ years. Previously, he had been associated in the oil business with H. R. Smith, and Continental Oil Co.

Steen, who headquartered at Victoria, Tex., as tool pusher, is moving to Alice to assume his new duties as assistant superintendent. He has been with Harkins and previous firms for 12 years.

Standard's retirement comes after long association with H. B. Harkins, president of Harkins & Co. He came to Alice in 1947 as drilling superintendent for Kirkwood & Morgan, Inc., and in 1949 became part owner with Harkins in the formation of Kirkwood & Co. He sold his interest in this firm when the present company was formed in 1956.

The new company owns six rotary rigs, one of which is being stacked at the company yards in Alice until drilling becomes more active. It has drilled more than 100 wells for its own account, and upwards of 200 more under contract for others.

With the advancement of Steen to assistant superintendent, remaining tool pushers are George Kilsby, J. W. Morgan, Frank Robbins, Roy Biggs, and W. H. Stewart. Top-level personnel in the company's own operations include, in addition to Harkins, Butler, and Steen; A. G. Holzapfel, landman; and Roy I. Jindra and J. B. Walton, geologists.

Who's getting the drilling contracts

Pernie Bailey, Houston, has the contract on the new deep wildcat operation Michel T. Halbouty, Houston independent, is starting in the Bell City area of southeastern Calcasieu Parish, southwestern Louisiana. Halbouty's test, 1-A Sweet Lake, in 4-11s-6w, is about 1¼ miles west of Bell City and about a mile north of South Bell City field. Drilling is projected to 11,500 ft.

Signal Drilling Co., Tulsa, is drilling on a newly spudded deep contract job in the Pacific Creek area of Sublette County, far-western Wyoming. Drilling is for G. L. Reasor, of Chicago, who plans to test the Mesaverde section to 13,500 ft., possibly to 15,000 ft. Location, at 1 Government-Reasor, in 28-27n-103w, is not far from the 20,521-ft. test with which Superior Oil Co. broke the world's depth record in 1949.

Olds & Wrather Drilling Co., Casper,, has a new wildcat job going in the Caryhurst area of Converse County, Wyoming. It is a 5,500-ft. Lakota test for Haynes and V-T Drilling Co., of Evansville, Ind. Location is 8½ miles east of South Glenrock field, nearest production.

Sprecher Drilling Co., Casper, has a rig working for Pan American Petroleum Corp. in northern Sublette

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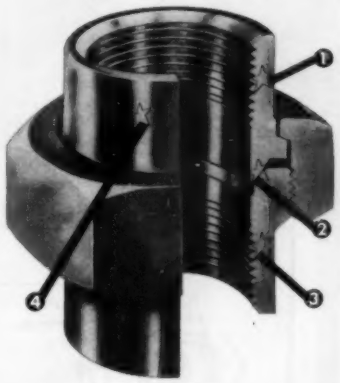
gives you all these features for your forged steel pipe union requirements



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4. **Round, straight barrels** for fast wrenching. No uneven or tapered surfaces to cause wrench slips or wrench locking!

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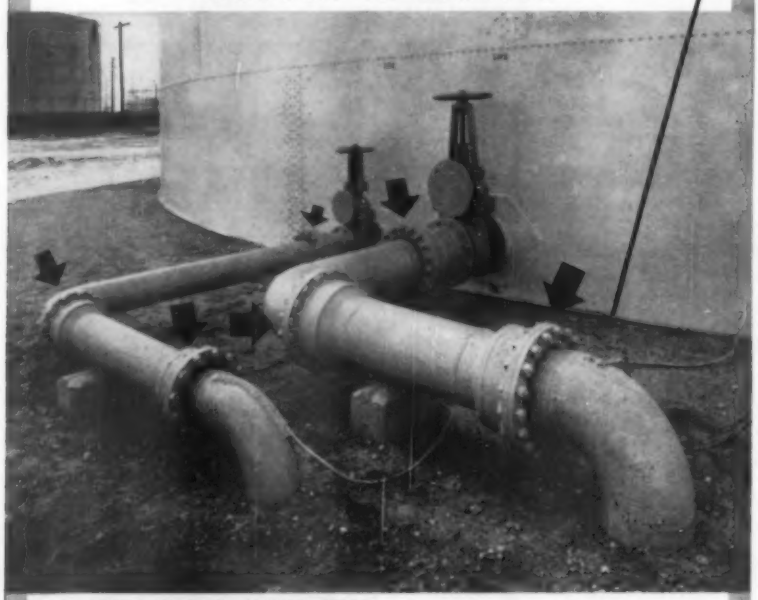

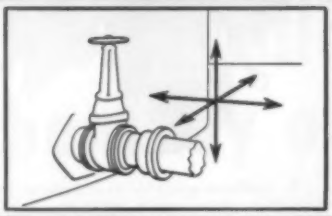

Allows 6-Way Movement!

Freedom of movement in any direction is readily possible with these *ball joint connections* of 12" pipe (right) and 8" pipe (left) to 80,203 bbl. tank shown in above photo. (Photo: SHELL OIL COMPANY, Dominguez Refinery, Wilmington, Calif.)

Barco Ball Joints—

provide complete protection against FIRE, EARTH SHOCK, TANK SETTLING

The rapidly increasing use of Barco's new large size Flexible Ball Joints in California, and other locations, is significant for several key reasons:

1. **Fire-Safe. The joints have passed rigid fire and water spray tests.**
2. **Unlimited flexibility and movement.**
3. **Long service life without maintenance.**
4. **Joints insulate against electrolysis as well as provide movement in all planes.**

Such installations protect piping, valves, and tanks from earth movements, shifts, shocks, and earthquakes. They allow for *tank settling* or *tilting* as well as for *thermal expansion* or *contraction of piping* leading to tanks without creating strain. In case of fire, the joints are "fire safe."

For detailed information, WRITE FOR CATALOG 215B. Joints available in steel with flanged or welding ends. 15° angular flex.

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County, western Wyoming. Location is on Pan American's Raspberry Ridge unit. This is the first test on the unit, far removed from any previous development. Plans call for a 5,000-ft. test to the Almy and Evanston formations.

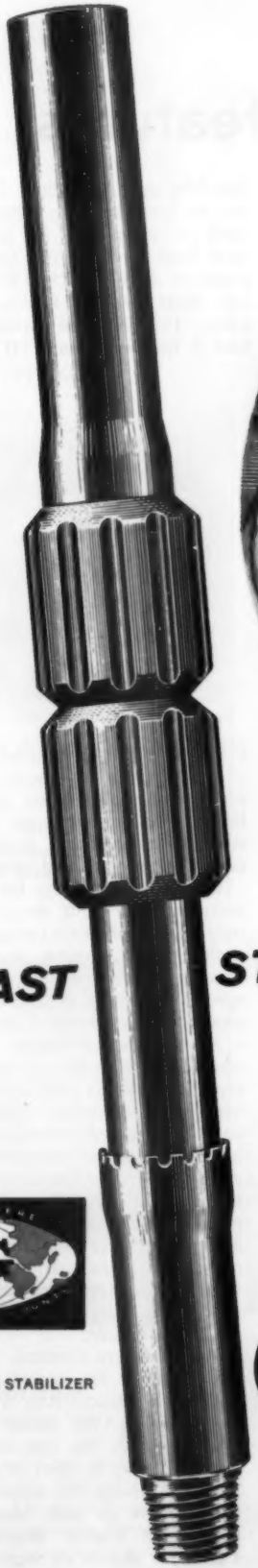
Miracle & Wooster Drilling Co.'s rig used on Sunray Mid-Continent Oil Co.'s recently drilled 7,900-ft. dry hole on the Bear Creek anticline in Crook County, Central Oregon, now is drilling for McCulloch Oil Exploration Co. in the Enumclaw area, in King County, Washington, 15 miles east of Tacoma. The new wildcat operation is more than 200 miles northwest of the Sunray job. It is 3 miles southwest of two dry holes McCulloch drilled in 1957, one to 6,023 ft. and the other to 4,326 ft.

Newton Drilling Co., Coalinga, Calif., is busy on an 11-well drilling program for The Texas Co. in the old San Ardo field, Monterey County, in Central California's Salinas Valley district. The wells are being drilled to the field's regular shallow Miocene sands ranging in depth from 2,100 to 2,400 ft. The program marks a resumption of development in the field for Texaco. The field, discovered in 1947, already has more than 650 wells.

Big "6" Drilling Co., Houston, has moved a rig it has had on a wildcat operation in Colorado County, on the upper Texas coast, to another wildcat location in Calhoun County, on the central Texas coast, where it is drilling for W. O. Bennett and Charles H. Folwell. The new operation is at 1 Foester, in the J. P. C. Kennymore Survey. It is a 9,600-ft. test.

Grey Wolf Drilling Co., Houston, is on a 11,500-ft. wildcat test for North Central Oil Co. in the Perry Point area of northern Vermilion Parish, Coastal Louisiana. Its location at 1 Kennedy, in 33-10s-2e, is about 2½ miles northeast of 10,000-ft. oil production discovered earlier this year by Charles B. Wrightsman at Perry Point, and about the same distance northwest of a 12,150-ft. gas-condensate discovery well completed by Sinclair Oil & Gas Co. last March.

Movible Offshore Co., Houston, has a new onshore drilling job in the Avondale area, west of New Orleans, in Jefferson Parish, Louisiana. It is a projected 10,000-ft. test for Herman Brown at 1 Gambino, in 15-13s-22e. Location is about ¾ mile northwest of production in Avondale field on the west bank of Mississippi River near the Huey P. Long Bridge.



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Modern drill string stabilization begins *far ahead* of the trip into the hole. Grant—with 30 solid years of manufacturing skill—designs, develops and produces in its own plant the most advanced stabilizing tools available, made under the most exacting manufacturing conditions.

For the full story on Grant Cushion Stabilizers, ask for Bulletin 63 and the free booklet "How to Avoid Crooked Hole."

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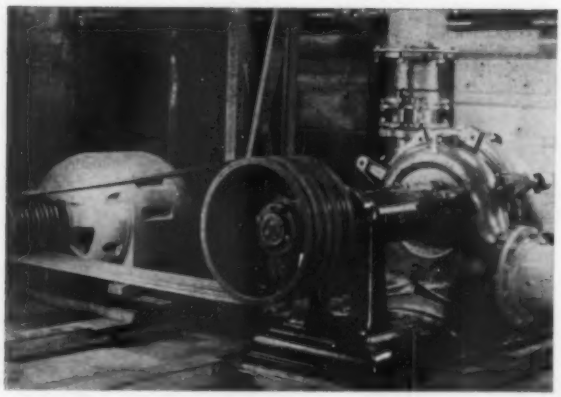
▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



Slurry pump for high tonnage

. . . is available with a variety of abrasion-resistant alloys and interchangeable, soft-rubber covered wear parts. The new 10-in. pump maintains high efficiency throughout the life of its long-wearing parts, the maker says. It provides continuous trouble-free operation without attention.

Maintenance costs are low because of simplified design, rugged construction, and quick, easy replacement of parts, the maker says. **Write or call: A. R. Wilfley & Sons, Inc., Box 2330, Denver, for details on 10-in. slurry pump.**

Plastic pipe has high ratings

. . . for use in natural-gas lines, chemical piping, deep-well piping, and electric conduit. It can be used at higher operating pressures and temperatures than any other thermoplastic pipe, the maker claims. The pipe is made from an improved Kralastic resin. It can be used at temperatures to 180° F.

The pipe is immune to electrolytic corrosion and corrosion from known soil conditions. It's also resistant to a wide range of corrosive chemicals. It can be cut with a hand saw and joined by solvent welding. The Schedule 80 pipe may be threaded with hand or power tools. It's available in sizes from ½ to 6 in., for working pressures of 100, 125, 150, and 200 psi. **Write or call: Carlon Products Corp., 10225 Meech Avenue, Cleveland 5, for details on HTHT pipe.**

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High-speed telepulse system

. . . is designed for precise remote reading of such process variables as liquid level, temperature, and pressure. A digital system, it gives remote control of motors and valves too.

Liquid-level readings have a ⅛-in. accuracy in a 60-ft. range and take only 12 seconds for a complete gaging cycle. Other process variables are transmitted with similar precision and speed. The user's own tank numbers and other identification can be used.

Selection, confirmation, and error checking are fully automatic. Self-reporting alarms indicate abnormal variables. Modular, building-block construction, and fail-safe circuits are used. Each pulse represents one increment of the quantity measured. Liquid level is transmitted as one pulse group representing whole feet and another representing eighths of an inch in excess of the last whole foot. In temperature or pressure transmission, a pulse represents each 1° or 2° increment.

All pulses are identical. This allows the signal to be carried over poor-quality lines successfully without message garbling, the maker says. The system allows the operator to find out if a valve is open or closed and lets him change the condition if desired. **Write or call: Shand & Jurs Co., 2600 Eighth Street, Berkeley Calif., for details on high-speed telepulse system.**

Send this **Showcase Coupon**

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

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Described in OIL AND GAS JOURNAL - Issue of **September 1, 1958**

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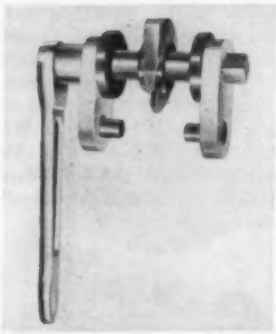


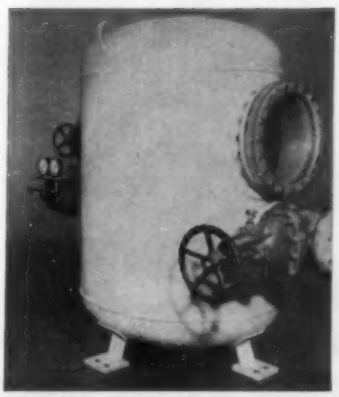
Tool uses circular-cam wedge

. . . for fast spreading of flanged pipe connections to insert gaskets and orifices. Named Safety Boy, the circular cam wedge, with a ratchet handle, makes a lightweight, handy-to-carry tool.

Operation of the tool is simple. First, all flange bolts are loosened and the necessary ones removed. The tool is anchored onto the flanges by insertion of pins into the flange bolt holes. At the same time, the tapered edge of the circular cam wedge is inserted into the opening between flanges. Force is easily applied by the ratchet handle to quickly spread the flange connection.

The tool is especially useful in close working space. **Write or call: Wm. L. Riggs Co., 565 South 126 East Avenue, Tulsa, for details on Safety Boy.**

●



Filter-water separator for fuel

. . . provides average solids impurities of less than ¼ gal. per 1,000 gal. of fuel. And entrained water is less than 0.001 ml. per liter of fuel, the maker claims. The unit is suited for JP-4, JP-5, AvGas, and diesel fuels. Though designed primarily for refineries, it's suited for tank farms too. The filter conforms to military speci-

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fication MIL-F-8508. It consists of a metal-tank assembly, covers, and several cylindrical filter-element assemblies mounted inside the tank. The individual element assemblies consist of two independent operating units.

The lower unit has a treated blanket of densely-compressed layers of fine glass fibers and other filter media. This blanket is wrapped on a perforated inner core and surrounded by a perforated cylinder. Plates attached to the end of the unit prevent channeling and assure fuel contact for the full depth of the filter media. This lower unit retains the solid contamination down to a fraction of a micron and also coalesces emulsified fuel-water mixtures.

The top filter element also has an inner perforated core. Around it a phenolic, resin-impregnated, pleated cellulose element is mounted. It has a large filter surface. This filter media is encased in a perforated metal cylinder with metal end caps. It provides a second filter for rejecting water droplets and retaining solid particles.

The Bendix filter-water separator comes in models with flow rates from 40 to 2,000 g.p.m. **Write or call: Bendix Filter Div., Bendix Aviation Corp., 434 West Twelve Mile Road, Madison Heights, Mich., for details on filter-water separators.**

Pipeline drill is self-propelled

. . . and drills blast holes up to 9 ft. deep. Called the Pipeline Blastholer, the rotary drilling unit needs only one operator. All controls are centrally located at the driver's position. The unit is not cumbersome, has extreme mobility, and travels over all types of terrain, the maker says.

Over-all width is 8-ft., 6-in.; frame length, 15 ft., and over-all height, including mast, is 19 ft., 7 in. A heavy-duty, all-welded, structural-steel frame is mounted on the track. It has a transmission with four forward speeds. The unit drills holes with diameters from 2¼ to 3⅞-in. at variable rotary speeds from 25 to 325 r.p.m. and constant, controlled down-pressure. **Write or call: Drilling Accessory & Mfg. Co., Inc., 2006 South Industrial Boulevard, Dallas, for details on Pipeline Blastholer.**

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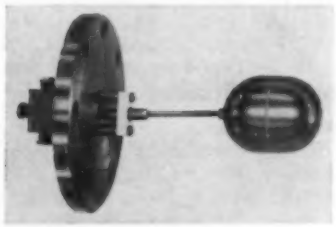

Air-operated, snap-action float switch

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The controller is available with either a mechanical coupling or with a conventional flanged connection. Horizontal mounting through a side entrance on the tank permits the liquid to raise the float and thus operate the snap-acting valve. **Write or call: Instruments, Inc., 122 North Madison, Tulsa, for details on SnapOmatic float switch.**

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Double-acting motor valve

. . . is designed for oil-metering vessels, oil and gas separators, and low-pressure burner-manifold valves. The Series DA valve operates at 125 psi. WP. Pressure may be applied to either or both sides of the diaphragm.

It's spring loaded to close against about 6 psi. upstream pressure. The valve has a single soft-seat, to insure tight shutoff and is full opening. It comes in sizes from ¾ through 6 in. **Write or call: Kimray, Inc., 52 Northwest Forty-second, Oklahoma City, for details on Series DA valve.**

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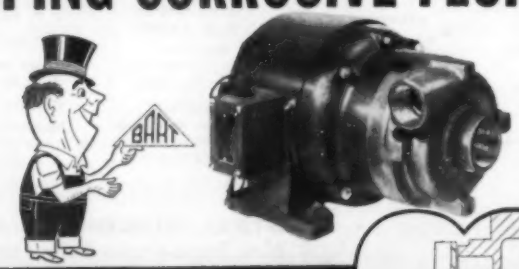

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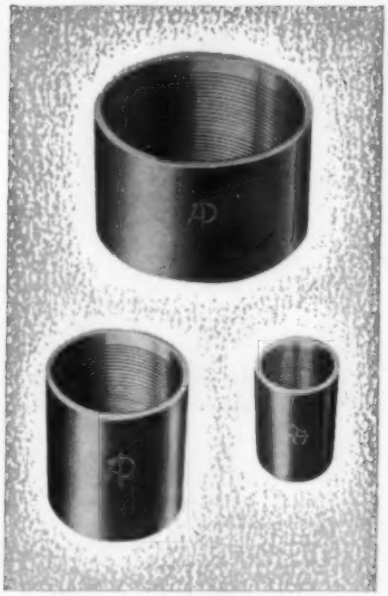

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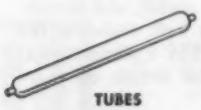

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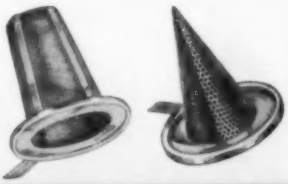

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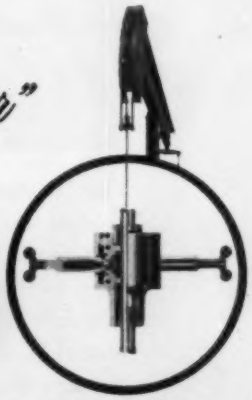

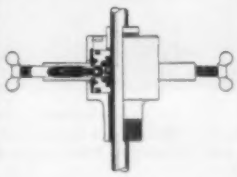

Compensating for off-vertical movement of the polished rod, gland moves in same direction as rod, and maintains relative alignment with rod. Rod bears only against wear bushing at top of box.

Maximum freedom from wear of rod and tubing, and consequent longer life, is assured by the new, improved Kinzbach "Type 241" polished rod stuffing box with full-floating action.

Free to move laterally to compensate for any "off center" stroke of the rod, the floating gland is packed with a self-lubricated plastic packing. It may be tightened, and additional packing may be added at any time, without shutting down the well. Most wear is taken on the inexpensive, easily replaceable wear bushing.

KINZBACH TOOL CO INC

EXPORT: 74 TRINITY PLACE, NEW YORK, N. Y.

KINZBACH TOOL CO., INC.

P. O. Box 277 • HOUSTON, TEXAS

JOHN ZINK BURNERS

. . . scientifically tested and performance rated to do the job RIGHT . . .

This research furnace affords an ideal proving ground for design changes in standard lines of burners, as well as enabling the John Zink Company to find *workable* solutions to new problems. In this way the John Zink Company can offer you special burners for your individual application . . . burners that have been *performance tested* before they reach your job site.

→ *The facilities of the John Zink research furnace are available to industry.*

WE MAKE HEAT . . . AROUND THE WORLD

If you have a specialized industrial burner problem . . . JOHN ZINK has the answer . . .

JOHN ZINK COMPANY

4401 SOUTH PEORIA TULSA 5, OKLAHOMA

Fuel gage for overhead tanks

. . . can be read from the ground. The gage shows true level, because the fuel flows through clear plastic tubing mounted vertically on the outside of the tank. Replacement of the tubing may be made easily at a cost of about 60 cents, the maker reports.

Installation can be made on any type of overhead tank in 5 to 15 minutes. Styles are available for either ¾ or 1-in. tank outlets. A pipe wrench, small wrench, and pliers are the only tools required. The gage consists of any length tubing desired and all necessary fittings. The tubing is impervious to gasoline and oil, and withstands temperatures from —60° to 175° F. It has a tensile strength of 2,200 lb. **Write or call: Byroad Mfg. Corp., 426 South Hancock Street, Indianapolis 22, for details on overhead tank-fuel gage.**

•

Stainless-steel insert flanges

. . . are marked to identify pipe size, pressure, grade, and heat code. The insert is of corrosion-resistant alloy while the flange is of carbon steel. They provide tight sealing. They also offer fast bolt hole alignment since the flanges can be rotated easily into position after inserts have been welded, threaded, or rolled to pipes or fittings.

Four styles of identified stainless-steel insert flanges are available. They are slip-on, roll-on, socket, and thread-on types. **Write or call: Stainless Insert Flange Co., 6526 Upland Street, Philadelphia 42, for details on marked insert flanges.**

Claymont's 160-inch plate mill in action. Fully integrated steel producing facilities and a complete range of fabricating equipment make Claymont a reliable source of quality steel plate and plate products for industry.

Photo by d'Arazien

CLAYMONT STEEL PLATES

CF&I

CHECK CLAYMONT FOR—Alloy Steel Plates • Carbon Steel Plates • Stainless-Clad Steel Plates High Strength Low Alloy Steel Plates • CF&I Lectro-Clad Nickel Plated Steel Plates • Pressed and Spun Steel Heads • Manhole Fittings and Covers • Fabricated Steel Products Large Diameter Welded Steel Pipe

PRODUCTS OF WICKWIRE SPENCER STEEL DIVISION • THE COLORADO FUEL AND IRON CORPORATION

Plant at Claymont, Delaware • Sales Offices in all Key Cities

5746

The new corrosion film everyone is talking about!

Here is an authoritative film that answers many questions on the theory of corrosion and demonstrates methods by which it is controlled. Presented in color and sound, it ranges from the formation of anodes and cathodes through the use of galvanizing, inhibitors, metallizing, cathodic protection, alloys and protective coatings. You will see how many corrosion problems in industries such as yours are being solved by Dimetcote, a one-coat zinc silicate protective coating. This film will be well worth 19 minutes of your time. To arrange a showing for you and your associates, or to learn when it will be shown in your area, contact any of the Amercoat offices listed below.

Typical audience reactions:

Bishop, Tex.—"Planning fair-sized test after seeing this film."

Louisville, Ky.—"Answers many questions. Second showing arranged."

Cincinnati, Ohio—"Key personnel evidenced considerable interest."

Netherlands Antilles—"Both shows led to 45-minute discussions."

Fairport, Ohio—"Very interesting. Will try methods shown."

Las Piedras, Venezuela—"Putting ideas to work in near future."

Bartlesville, Okla.—"Viewed by 42 key men from five divisions."

Answers these and other questions:

What produces electrolytic corrosion?

What factors favor hot-dip galvanizing?

How important is surface preparation?

Can a coating survive a tank fire?

Can rust in tankers be controlled?

Can a coating offer cathodic protection?

What are the corrosion problems on offshore rigs?

What are the advantages of zinc silicate?

How can chemical plants cut painting costs?

Amercoat® CORPORATION

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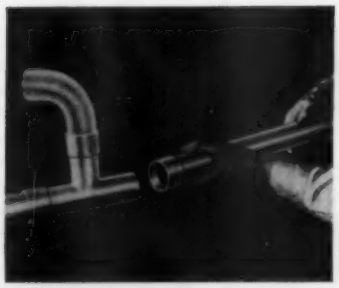
South Gate, California

- 921 Pitner Avenue • Evanston, Illinois
- 2404 Dennis Street • Jacksonville, Florida
- 360 Carnegie Avenue • Kenilworth, New Jersey
- 6530 Supply Row • Houston, Texas

1124



Stainless connector fits over ends

. . . of pipe or fittings to provide a socket type of joint. The connector provides a snug fit that holds the pipe and fittings in position until welding or brazing secure the connection. The connector also makes possible in-place preassembly of complicated process-piping layouts.

It's designed to be used with Speedline fittings and lightwall piping systems, Schedules 5 and 10. It fits over the fittings as well as the pipe since the straight section on Speedline fittings provides clearance for assembly. **Write or call: Horace T. Potts Co., 504 Erie Avenue, Philadelphia, for details on stainless-steel aligning connector.**

Explosionproof hour meter

. . . for hazardous locations is now available. It's designed for use on gasoline or diesel engines, generators, or air compressors. Available for 12 and 32-volt d.c. applications, the instrument is housed in an explosion-proof case.

It tells you at a glance the actual hours and minutes of engine operation. Thus lubrication, oil and filter change, overhaul, inspection, cost of specific jobs, and fuel and oil consumption can be planned and recorded. Electrically wound, the hour meter is an accurate, rugged instrument which records hours and tenths on a quick-reading odometer. **Write or call: John W. Hobbs Corp., Yale Boulevard and Ash Street, Springfield, Ill., for details on new hour meters.**

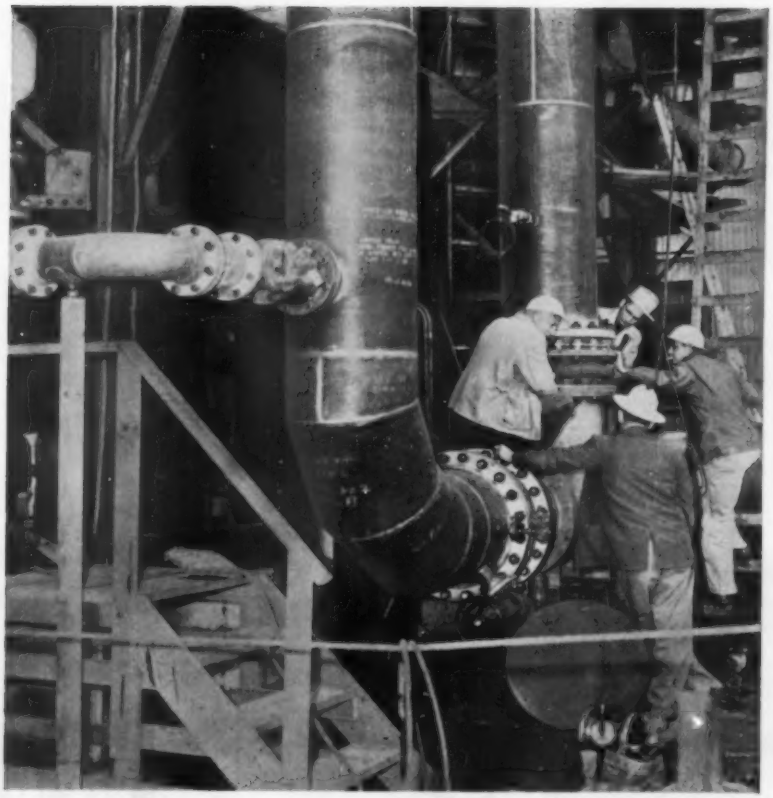
Flowmeter for direct reading

. . . of total mass independent of temperature and pressure variations is now available. Designed to measure mass flow of air or other gases, it's calibrated directly in milligrams of air per minute and available in several flow ranges. It's well suited for measuring low rates of flow such as in gas chromatography.

A heated thermopile element in a flow tube is used to measure mass flow. The thermopile circuit is self-compensating for both ambient temperature and rate of change of temperature. This flow tube can be installed directly in the flow line. In large lines, it can be placed in a bypass to measure a fraction of the total flow.

The model MF-1 mass flowmeter has a range from 0 to 10,000 mg. of air per minute. But it offers highest accuracy and maximum readability

Up to 20 H.P.
Single Phase
Power for remote areas
NEW
R&M
"All Weather 40"
OIL COUNTRY MOTORS
Eliminate maintenance and the problem of constant attention by replacing Internal Combustion engines with R&M Single Phase Motors! Sizes above 7½ hp (10, 15, 20 hp) have "cushion start" system as extra-cost option, for reduced current starting. Auxiliary mechanism is externally mounted for simple inspection, even while the motor is running. Motors are fully weatherized against moisture, dirt, heat. Write for Bulletin 470-OG!
ROBBINS & MYERS, INC.
MOTOR DIVISION • SPRINGFIELD, OHIO



Erecting piping at a potash refinery in the Southwest. In nine months, there has been no stress-corrosion cracking—yet pipe and fittings were not stress-relieved or heat-treated during fabrication.

Field-fabricated without stress-corrosion cracking!

Pipe and fittings are of NEW AMPCO METAL GRADE 8

Forget your old ideas about fabricating copper-base alloy equipment to handle steam and corrosive media at elevated temperatures. New — *entirely new*—Ampco Metal Grade 8 changes all that!

Now, for example, you can get pipe and fittings that

- ... can be field-assembled, without stress-relieving — yet won't stress-corrosion crack!
- ... provide many times greater protection against corrosion and erosion
- ... can be readily welded
- ... can be formed on standard equipment
- ... are too tough to be chewed or crushed by wrenches
- ... are available in all standard types and sizes — also specials.

At one major oil refinery, field-assembled piping of Ampco Metal Grade 8 has handled hot sulphuric-acid sludge for a year and a half without stress-corrosion cracking.

Sound promising? It is! Ask your Ampco field engineer about new, patented Ampco Metal Grade 8. Or write for details. *Ampco Metal, Inc., Dept. 161-I, Milwaukee 46, Wis. West Coast plant: Burbank, Calif. —Southwest plant: Garland (Dallas County), Texas.*

TS-3

AMPCO®

AMPCO

for air flows in the range from 50 to 1,000 mg. per minute. It's priced at $115, including flow tube and cable. The Model SM-1 has a range of 0 to 500 mg. of air per minute. It sells for $215 including flow tube and cable. **Write or call: Hastings-Raydist, Inc., Hampton, Va., for details on Model MF-1 and SM-1 mass flowmeters.**

●

Regulator inlet pressure increased

. . . from 1,000 to 1,500 psi. The Model 141 regulator is particularly useful along isolated gas-transmission lines where small-volume service requires the lines to be tapped directly. The regulator is especially designed to handle primary cuts in pressure. The outlet pressure range is from 3 to 400 psi. **Write or call: Rockwell Mfg. Co., Meter & Valve Div., 400 North Lexington Avenue, Pittsburgh 8, for details on Model 141 regulator.**

●

Putty seals cracks in concrete

. . . and it's tough and semi-resilient. Called Epocast 543, and with Hardener 9814, it forms a seal which bonds effectively to old and new concrete. Its inherent resilience permits it to accommodate movements within the concrete structures.

Possessing good water resistance, it may be adapted to sealing of underground structures. Priming may be necessary. **Write or call: Furane Plastics, Inc., 4516 Brazil Street, Los Angeles 39, for details on Epocast 543.**

●

Acid hose designed for corrosive

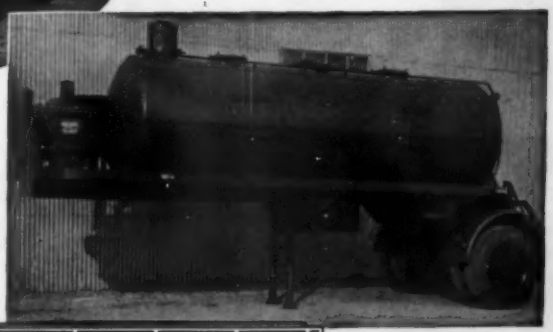
. . . service is now available. Tradenamed Commander, the acid hose contains a special hose tube made of newly developed acid-resisting material. The tube withstands 96% sulfuric acid at 70° F. as well as strong oxidizing acids and other chemicals, the maker says. **Write or call: B. F. Goodrich Industrial Products Co., Akron, Ohio, for details on Commander acid hose.**

MOVING DRILLING MUD *FAST!*

Just for the record, this moving job during a changeover was timed, and here are the results: Exactly 8 minutes, 33 seconds after the driver yanked up on the emergency brake, 45 bbls. of 12 lb. mud was snugly inside the Thompson Unitized Vacuum Tank!

TO THE NEXT HOLE

From there to the next hole was discounted as driving time. Starting the stop watch again when the driver had backed up to the shaker pit, the one man laid hose, opened the valve and had the tank empty in 4 minutes 10 seconds.



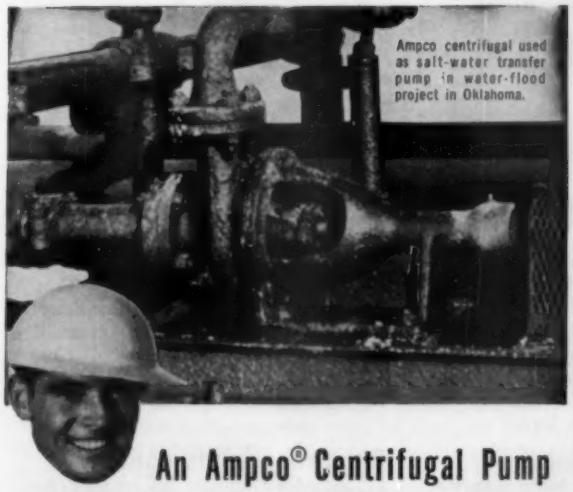
This new Vacuum Tank Trailer, complete with engine and pump, is now available. Write for specifications and price!

GET ALL THE FACTS

There's a Thompson Unitized Vacuum Tank built to do your jobs fast, too! Cleaning tanks, draining sumps, pumping out cellars, agitating mud, spraying roads, weeds, etc., are everyday chores for this workhorse. Check UVTs: 20-100 bbls. capacity; truck, trailer, semi-trailer or skid mounted.

THOMPSON
TANK and MANUFACTURING CO. Inc.
2019 EAST WARDLOW RD. LONG BEACH 7, CALIFORNIA

SOLE LICENSEE TO MANUFACTURE VACUUM TANKS UNDER U.S. PATENT NO. 2522077



Ampco centrifugal used as salt-water transfer pump in water-flood project in Oklahoma.

An Ampco® Centrifugal Pump thrives on salt water!

Engineered to resist velocity, erosion and corrosion. Extra protective features—at no extra cost — reduce maintenance and downtime.

Available *from dealer's stock* in stainless steel, Ampco Metal, and Illium "G" — and with elastomer or rubber linings. See your Ampco Pump Distributor.

P-41

WRITE FOR BULLETIN P-3B

AMPCO

AMPCO METAL, INC. Dept. 1691, Milwaukee 46, Wis.

WEST COAST PLANT: BURBANK, CAL. • SOUTHWEST PLANT: GARLAND (DALLAS CO.), TEX.

resort luxury in downtown Miami

the fabulous new bayfront accommodations—one-of-a-kind rooms and suites for VIP's and truly discriminating guests!

the famed Top O' the Columbus—gourmet food; a continental selection of fine wines; spectacular views of ocean, bay, and city!

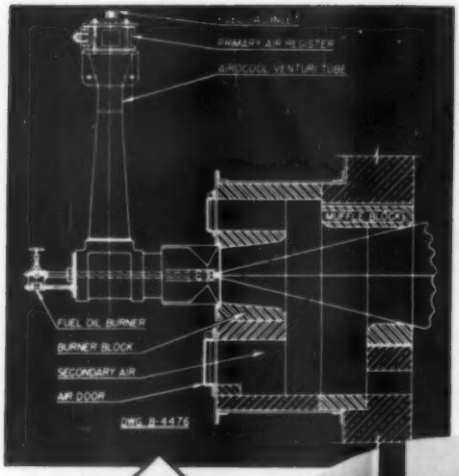
the convenient headquarters for your stay —downtown airlines terminal; near smart shops, theatres, and offices.

Completely Air Conditioned!

The Columbus Hotel

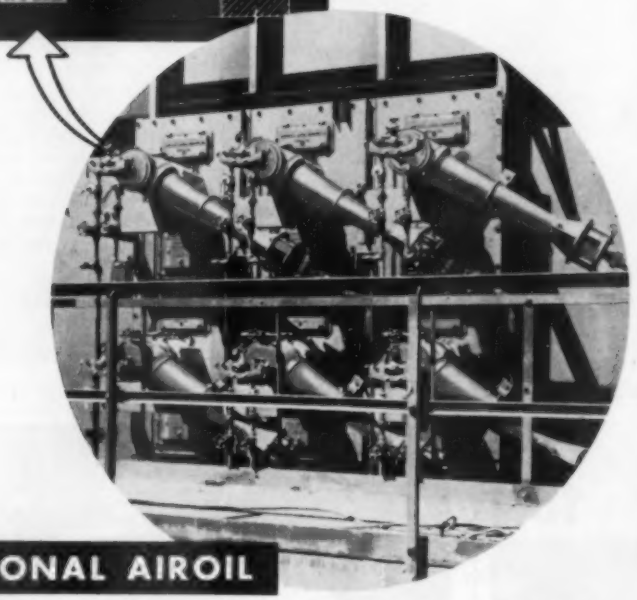
Biscayne Blvd. at First Street
Miami, Florida

For reservations, call Miami, FRanklin 3-2671



Firing

CRUDE DISTILLATION UNIT HAVING WORLD'S HIGHEST THRUPUT . . .



NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Looming large in the effort to meet increased products demand on the petroleum industry is Tidewater Oil Company's ultra-modern Delaware Refinery, for which C. F. Braun & Co. were the engineers and constructors.

At the Tidewater Oil Company's ultra-modern Delaware City refinery this huge crude furnace for a world's record capacity of 130,000 barrels per day is equipped with National Airoil Burner Company's exclusive Tandem Block Combustion Units which are easily capable of exceeding the designed capacity of the furnace when burning either liquid or gaseous fuels.

These Tandem Units will burn up to high viscosity residuum oils and/or varying molecular weights of refinery gases. They have high individual heat liberating capacity as well as turn down ratio on natural draft thus avoiding the cost of a blower system. They will operate with low excess air.

Because these high combustion efficiency Tandem Units liberate a large proportion of heat by flame radiation to the heat absorbing surfaces, they increase the days on stream by reducing flame impingement with its accompanying high maintenance cost to tubes, brick work, etc.

National Airoil

BURNER COMPANY, INC.

Main Office & Factory: **1236 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.**

SOUTHWESTERN DIVISION 2512 SOUTH BOULEVARD, HOUSTON 6, TEXAS

SHOWCASE . . .

New Literature

Malfunction-detector Bulletin RF-586

. . . describes operating principles, installation diagrams, dimensions, and adjustment considerations of the Model 65 Vibraswitch. It's a four-page bulletin. The unit is said to provide protection for large motors, pumps, compressors, and other rotating equipment by responding to mechanical malfunctions the instant they occur. Failing bearings, bent shafts, broken blades, overspeeding, and similar malfunctions cause increased imbalance or high-frequency vibration detectable with the device. It may be wired to actuate an alarm or cause shutdown before damage occurs. **Write or call: Aeronautical & Instrument Div., Robertshaw-Fulton Controls Co., Euclid Avenue at Santa Ana Freeway, Anaheim, Calif., for Bulletin RF-586.**

Nomograph for sizing chemical feed

. . . systems is now available. To use the nomograph, you must know the concentration of the chemical solution to be metered, the required chemical dosage, and the flow rate of the process stream. Using this information to draw two straight lines on the nomograph, you will know the necessary pump capacity in gallons per hour and the number of gallons of tank-holding capacity needed if the tank is to be refilled every 3, 12, 16, 24, 36, or 48 hours. The nomograph also gives the sizes of pumps that are 20, 50, or 100% over capacity for when these margins of safety are desirable. It's printed on an 11 by 17-in. sheet so that the results are consistent with standard engineering practice. **Write or call: Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, for chemical-feed systems nomograph.**

Expansion-joints catalog

. . . includes complete information for rating expansion joints subjected to axial or lateral movement, angular rotation, or combinations of these movements. The 80-page booklet also features formulas and tables for calculating the forces and/or bending movements developed in the connected piping or equipment. It also includes tables of dimensions and weights for expansion joints from 3 to 72-in. diameter. **Write or call: Badger Mfg. Co., 230 Bent Street, Cambridge, Mass., for Expansion Joint Catalog.**

Ductile-iron-pipe lock couplings

. . . are reviewed in new four-page Catalog PL-1. The catalog lists the cost-saving advantages of the Series K ductile-iron fittings. It includes pressure ratings for various sizes as listed by Underwriters' Laboratories, Inc., and illustrations of how to install the fittings and recommendations for their use. The catalog also contains price lists and size information for installing with Schedule 40 steel pipe. The fittings are available in two weights: 800-D (heavy) and 400-D (light). **Write or call: Kuhns Bros. Co., 1800 McCall Street, Dayton, for Catalog PL-1.**

Diesel engines

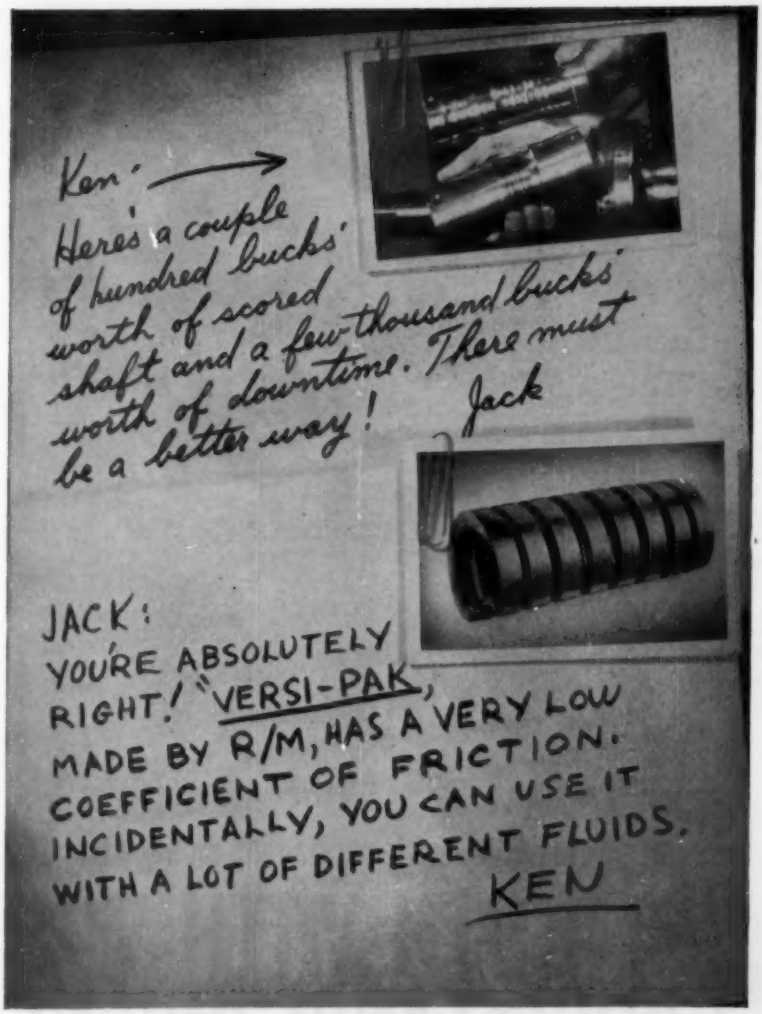
. . . with ratings from 248 to 2,890 b.hp. are described in two new bulletins. Made in England, the engines are the English Electric Co. RL Mark II and RK/V types. The RL Mark II engines, for use with generators and pumps, are totally enclosed, multicylinder, verticle engines with a bore and stroke of 15 by 20 in. The RK/V engines, for similar service, come in both in-line vertical and V-type, multicylinder engines. Both bulletins show construction features and include specifications and installation data. **Write or call: Diesel Engine Div., English Electric Co., Ltd., Brownsover Hall, Rugby, England, for bulletins on RL Mark II and RK/V engines.**

Methods of splicing wire rope

. . . are detailed in a new 38-page handbook. The booklet is written to help you obtain longer life from wire rope and acquaint you with certain safety standards to be maintained in the use and care of wire rope. It covers eye-splicing methods, endless splices, preformed and lang-lay wire-rope splicing, and the Chicago technique. It includes grommets, sacketing of ferrules, and efficiencies of wire-rope attachments—together with an engineers' notebook on wire-rope construction and specifications. **Write or call: Union Wire Rope Corp., 2102 Manchester Avenue, Kansas City 26, for Wire Rope Splicing handbook.**

All makes of sucker rods

. . . are compared on the basis of mechanical and chemical analyses in a new four-page brochure. The brochure includes the new specifications released by various sucker-rod makers. Categories include carbon manganese, 1¾% nickel, high-strength, and miscellaneous rod comparisons. A technical description of Axelson's 59, 60,


Ken:
Here's a couple of hundred bucks' worth of scored shaft and a few-thousand bucks' worth of downtime. There must be a better way!
Jack
JACK:
YOU'RE ABSOLUTELY RIGHT! "VERSI-PAK", MADE BY R/M, HAS A VERY LOW COEFFICIENT OF FRICTION. INCIDENTALLY, YOU CAN USE IT WITH A LOT OF DIFFERENT FLUIDS.
KEN

If the combination of high pressure, high shaft speed, and lubricant loss is making big headaches for you, get the details on "versi-pak"® from R/M's experienced packing engineers. This non-jacketed plastic packing gives you outstanding service in a great variety of applications with solvents, caustics and weak acids. It provides excellent retention of its original lubricant, reduces heat build-up.

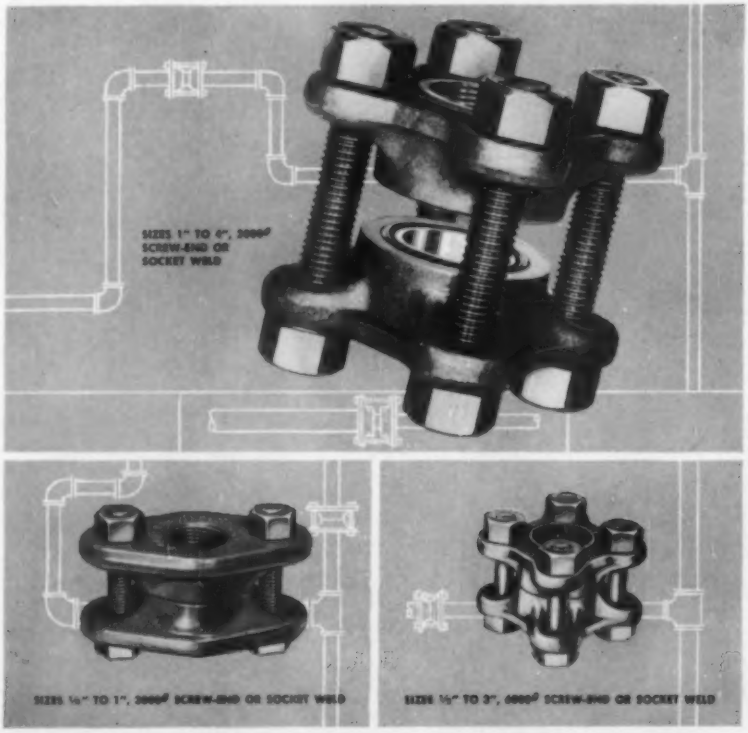
R/M "Universal" Plastic Packings, available in five different types, are recommended for those applications in which jacketed plastic packings containing flake graphite or mica are indicated. Their service range is so varied that you are urged to call on R/M for further details and specifications. R/M engineers have amassed a wealth of experience in the oil and gas field, and this experience is at your disposal. Call on R/M!

R/M MAKES A COMPLETE LINE OF MECHANICAL PACKINGS—including Vee-Flex,* Vee-Square,* Universal Plastic, and "versi-pak"®; GASKET MATERIALS; and "TEFLON"* PRODUCTS. SEE YOUR R/M DISTRIBUTOR.
*A Du Pont trademark

R/M
PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

RAYBESTOS-MANHATTAN, INC., Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics
Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings
Brake Blocks • Clutch Facings • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

The double diamond assures double value



Installation flexibility with permanent piping strength

GET BOTH WITH W-S O-RING FLANGE UNIONS

NOW, you can install high pressure piping systems that can easily be rearranged and adapted with full assurance that the unions will give the leak-proof service of permanent installations. This is made possible by these adaptable features of W-S O-Ring Flange Unions:

- Available in 2-bolt and 4-bolt types, according to size.
- Sizes ¼" to 1" in 2-bolt 3000#; sizes 1" to 4" in 4-bolt type 3000#; sizes ½" to 3" in 4-bolt type only 6000#.
- Available in Screw-end and Socket Welding Types—3000# and 6000#.
- O-Rings available in a variety of materials for a wide range of service.

Specify forged steel W-S O-Ring Flange Unions for a tight seal against fluid pressure in piping for hydraulic machinery, refrigeration piping, steam and water lines, process liquid and gas lines, and many other applications.

For full specifications, write for Bulletin U-1-58

W-S manufactures a full range of high quality drop forged fittings, unions and couplets . . . in carbon, stainless and alloy steels. For full information about these products, or for your specification forging requirements, write to: W-S Fittings Works, H. K. Porter Company, Inc., Box 95, Roselle, N. J.

H. K. PORTER COMPANY, INC.

FORGE AND FITTINGS DIVISION

W-S Fittings Works, Roselle, N. J. • Cleveland Forge Works, Cleveland 4, Ohio
Stainless Steel Works, Duncannon, Pa.

77, and 79 sucker rods is also included. **Write or call: Axelson Mfg. Co., Div. of U. S. Industries, Inc., P. O. Box 58335, Los Angeles 58, for sucker-rod brochure.**

Automatic methods of sampling

. . . directly from pipelines are described in new eight-page Bulletin SM 9475-2. It describes such technical aspects as line stratification flow profile, sample probe location, and economic factors. Two basic methods—time-proportional and flow-proportional sampling—are described, and various devices for each are analyzed. **Write or call: Proportioneers, Inc., 345 Harris Avenue, Providence, R. I., for Bulletin SM 9475-2.**

Water distillation and concentration

. . . equipment is detailed in a new eight-page bulletin. The bulletin describes the operating principle of thermocompression distilling equipment. It contains pictures of models and installations. Dimensions and weights are included. The equipment, which will produce pure drinking water from seawater, is available in a self-contained packaged unit. **Write or call: Mechanical Equipment Co., Inc., 861 Carondelet Street, New Orleans 12, for thermocompression evaporator units bulletin.**

Boilers for burning carbon monoxide gas

. . . in refineries are described in a new 20-page catalog. Entitled "C-E Boilers for Catalytic Regenerator Waste Gas," the catalog explains design features of these boilers which are intended to recover both chemical and sensible heat from refinery waste gas. Cutaway views of construction features and tangential burners are included along with four pages of engineering data on waste fuel products. **Write or call: Combustion Engineering, Inc., 200 Madison Avenue, New York 16, for C-E Boilers catalog.**

Industrial diesel engine

. . . that's a four-cylinder, four-stroke, in-line diesel model is featured in a new four-page bulletin. Called the Four 99, the engine is designed to meet the need for a small power unit for light types of industrial applications. Data on the engine, specifications, and engine ratings are included. **Write or call: F. Perkins, Ltd., Peterborough, England, for Four 99 Industrial Diesel Engine bulletin.**

J. W. Robbins appointed

J. W. Robbins

. . . vice president and general sales manager of The Parkersburg Rig & Reel Co., division of Parkersburg-Aetna Corp., according to B. P. McDonough, president of Parkersburg-Aetna. Robbins succeeds A. G. Evans-Lombe. Robbins will have complete charge of all sales policies and sales personnel. He joined the company 18½ years ago.

Corrosion Services expands

. . . its operations into the Cleveland, Ohio, area, according to Yale W. Titterington, Corrosion Services, Inc.'s general manager. Hartley J. Davis, formerly Tulsa office manager, has been transferred to Cleveland as manager of the new facility. CSI is a distributor of The Dow Chemical Co.'s magnesium anodes, Goodall rectifiers, and complete line of related cathodic protection supplies.

Orbit Valve Co. announces

. . . changes in its sales organization set up and firm representation, reports L. E. Wallace, general sales manager. J. J. Gavin, eastern sales representative, Pittsburgh, Pa., has been promoted to eastern division sales manager. Don DeSirey, Tulsa area sales representative, transfers to Odessa, Tex., to replace Don O. Meeker, who is assigned to Farmington, N. M. J. F. Brunsman shifts from Farmington to Oklahoma City. Joe Schoeffler has transferred from Houston to be the Tulsa area sales representative. Charles Lowe Co., San Francisco, will represent Orbit in northern California, Oregon, and Washington. Marshall E. Niedecker Co., Signal Hill, Calif., will represent the company in southern California.

Reed Roller Bit Co. elects

. . . Ray O. Shaffer, president of Welex, Inc., a director who will also serve as chairman of the board of directors. John F. Maher, formerly president of Oil Center Tool Co., was

R. O. Shaffer

J. F. Maher

elected a director and new president of Reed. A. H. Rowan, chairman of the board of directors of Rowan Drilling Co., was also elected a new director. Announcement was also made of the retirement of Rex G. Hamaker, director and president of Reed.

Oil Well Supply Div. shifts

. . . Menifee N. Swisher, store manager, from Powell, Wyo., to Farmington, N. M., reports R. L. Armstrong, Rocky Mountain area manager of the division of U. S. Steel Corp. Swisher joined Oilwell in 1946 at Cut Bank, Mont. He moved to Powell in 1952.

Grove Valve appoints

. . . three regional sales managers, a service manager, and names George E. Doty as vice president and general sales manager of Grove Valve & Regulator Co., reports M. H. Grove, president. Doty will headquarter in Oakland, Calif. R. L. Briggs will serve as Central regional sales manager at Tulsa. W. J. Hancock will head the eastern region with offices in Houston, and C. W. Cook will direct western region sales also headquartered in Houston. F. A. Fergusson will locate in Houston, but will have nationwide responsibility as service manager for the company.

Cherokee Laboratories acquires

D. A. Garrick

. . . McNamar Boiler & Tank Co., which has merged with Southwest Steel Co. and Santa Fe Steel Co., both of Tulsa, according to D. A. Garrick, president of Cherokee Laboratories, Inc., and James Jackson, president of McNamar. The new firm will be temporarily named Southwest Steel Co. and all manufacturing will be at the McNamar plant location. Garrick will be president of the new combine and Jackson, vice president. The company will be a subsidiary of Cherokee. It has purchased the equipment, facilities, and license to manufacture Trusdeck, a steel decking with an attached truss, from Trusdeck of Texas, Dallas.

General Electric Co. receives

. . . three orders from overseas oil companies for electric drives to be used in offshore and land oil well drilling for its locomotive and car equipment department in Erie, Pa. One order, for National Supply Co., was received through Royal Dutch Shell's Asiatic Petroleum. The other two were placed by Nuovo Pignone, Italian licensee for Ideco, one of the Dresser Industries. Destined for operations in Nigeria, the Shell order consists of three GE-752 drilling

Schlumberger Well Surveying Corp. adds Seismic Reference

. . . to its other services to the petroleum industry. The picture shows units for the new activity in position at a well. The service was initiated in the Permian basin during July and will be extended to other regions as justified by the demand. This package velocity service provides complete velocity data for both well evaluation and geophysical exploration in the well vicinity. It combines the Schlumberger Sonic Log with seismic check shots between levels in the borehole and the surface.

Seismic velocity measurements are performed by Century Geophysical Corp. as subcontractor. Seismic equipment is supplied by Century with the Schlumberger field unit being used for operations in the well. The Seismic Reference Service provides complete handling of the entire operation—for seismic shooting, surface surveying, sonic logging, obtaining necessary permits shothole drilling, shothole velocity recordings, well geophone recordings, and comprehensive computation of results.

motors, three GE-752 drilling generators, and controls. The equipment will first go to England to National Supply's subsidiary, Oil Well Equipment Co., for installation on the drilling equipment. For use in the Sicilian oil fields, equipment in Nuovo Pignone orders consists of four GT-558 drilling generators, controls and cable, and three GE-752 drilling motors each. To be installed on two land rigs, the equipment is being shipped to the Nuovo Pignone factory in Florence, Italy.

Sales personnel attend general sales meeting

...of W. C. Norris, Manufacturer, Division of Dover Corp., Tulsa, under the direction of G. W. Davidson, Jr., vice president, sales. Representatives of Oklahoma, Louisiana and East Texas, Kansas, Rocky Mountain, and Illinois basin areas met in Tulsa for concentrated attention on sales programming and product lines. Those attending are; first row; J. E. Giles, city sales; A. L. Ethridge, Oklahoma City, D. P. Hagaman, sales manager; W. L. Butler, president; G. W. Davidson, vice president, sales; J. A. Getty, division sales manager; and J. C. Schaff, Tulsa. Second row: Dan Coates, Farmington, N. M.; Homer Hill, Ardmore; Bill Forcum, Denver; Bill Peterson, Shreveport; W. C. Tolleson, Kilgore, Tex.; Don Durbin, Lafayette, La.; Kenneth Hance, Salem, Ill.; and A. A. Hardy, chief engineer. Third row: Clyde Sights, Tulsa; Earl Carpenter, Tulsa; J. G. Russell, Oklahoma City; LeRoy Mitchell, Casper, Wyo.; Earl Johnson, assistant chief engineer; R. L. Preston, Wichita, Kans.; R. A. Colgin, vice president, manufacturing; Bill Robinson, Calgary, Alta.; and C. T. Fair, Great Bend, Kans.

Bethlehem Steel Co. appoints

...S. S. Fox as assistant manager of sales, wire rope and strand division, and Gene LaSchober, Jr., as assistant manager of sales, pipe and tube division. Fox joined Bethlehem in 1937 as a salesman in wire rope and strand. LaSchober was employed by the company in 1935 and in 1947 became a salesman in the pipe and tube division.

Floyd L. Scott retires

...from Hughes Tool Co. He was director of the research engineering department and a member of the board of directors. He had been with Hughes 41 years. In announcing Scott's retirement, F. W. Ayers, senior vice president stated that Scott will continue to serve the company in a consulting capacity.

F. L. Scott

Robert S. Warren named

...to the post of advertising manager of The Cooper-Bessemer Corp., according to Stanley E. Johnson, vice president and director of sales. In his new position Warren will direct

"A dollar for a brick for th' new employes' recreation building? Why, Cookie can bake you a dozen for less than that!"

THE OIL AND GAS JOURNAL

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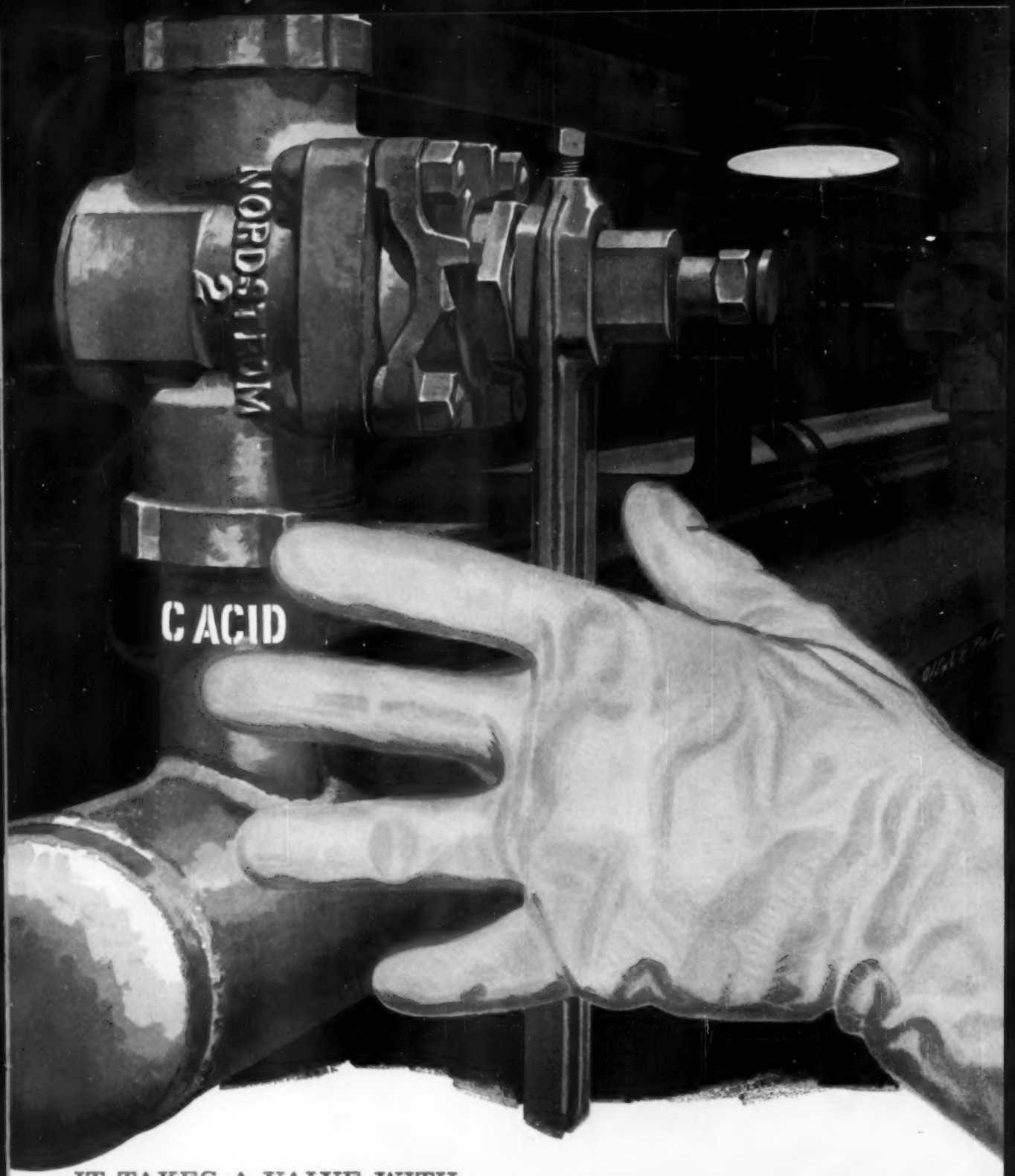

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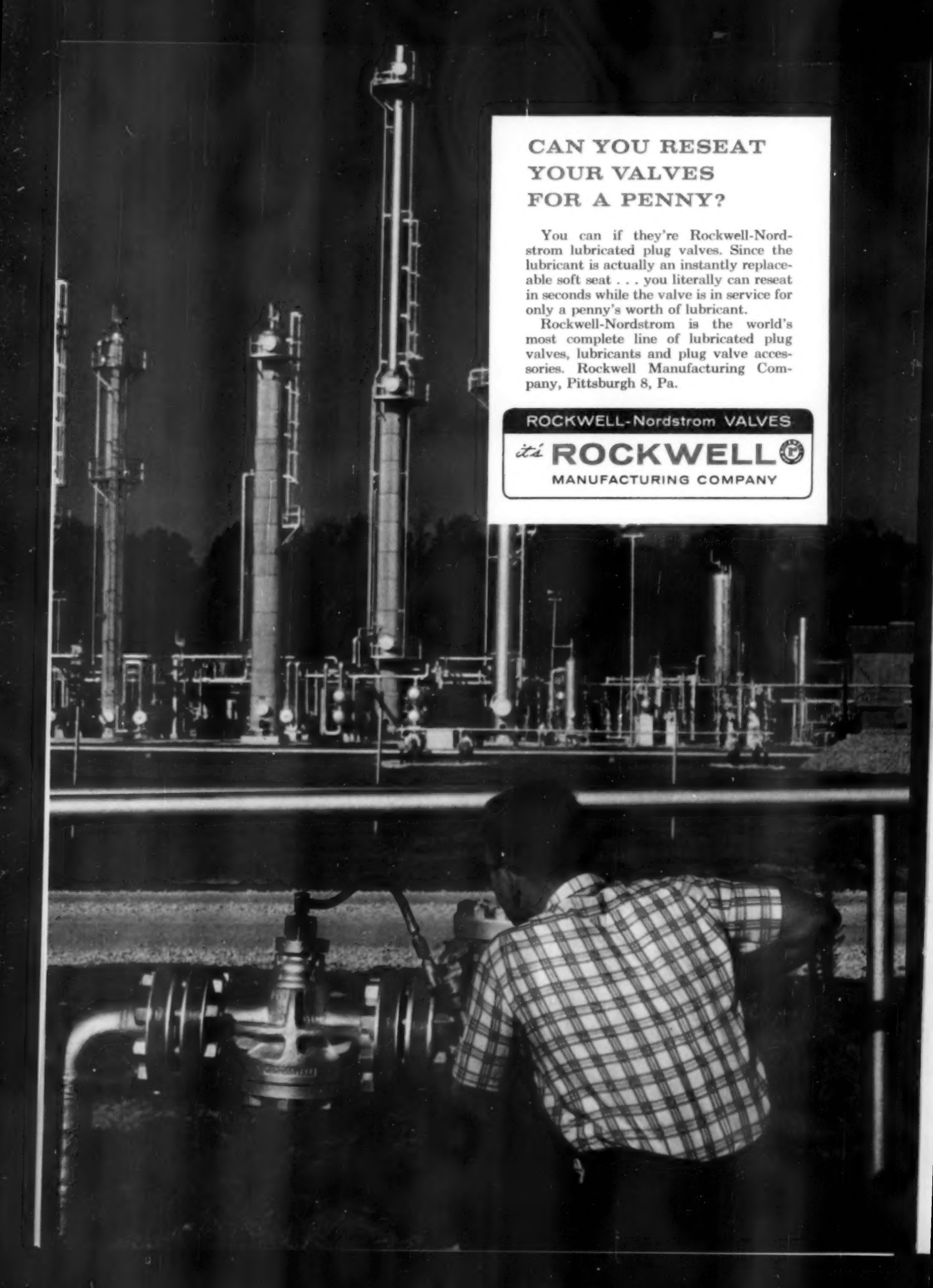
to stay trouble-free and seal tightly on acid and slurry service . . . it takes a Rockwell-Nordstrom lubricated plug valve. Fully protected seats and pressurized lubricant sealing insure positive shut-off, trouble-free operation. Since they cost no more to buy, you pay less for "premium" performance.

Rockwell-Nordstrom is the world's most complete line of lubricated plug valves. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

ROCKWELL-Nordstrom VALVES

it's **ROCKWELL**

MANUFACTURING COMPANY



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ROCKWELL-Nordstrom VALVES

it's ROCKWELL

MANUFACTURING COMPANY

the company's advertising and sales promotion. He has been with the company's marketing activities for over 14 years. He joined Cooper-Bessemer in 1945. He replaces Eugene R. Bonnist.

J&L Supply Div. makes changes

. . . in the field sales organization, according to A. G. Bastian, manager field sales division. G. C. Pryor, salesman at Laurel, Miss., becomes store manager there. L. R. Elston, store manager at Virden, Man., is assigned as store manager at Estevan, Sask. P. C. Smith, salesman at Woodward, Okla., is now assistant store manager at Morgan City, La. E. B. Clark, storeman at Houston becomes assistant store manager at that location. D. C. Jones, store manager at Muenster, Tex., transfers in the same capacity to Graham, Tex. L. E. Owen, storeman advanced at Muenster has been promoted to store manager there.

Continental-Emsco Co. names

. . . E. L. Gamble as assistant division manager, Kansas-Oklahoma-North Texas division, and George W. Ppool as manager for the Kansas district.

E. L. Gamble

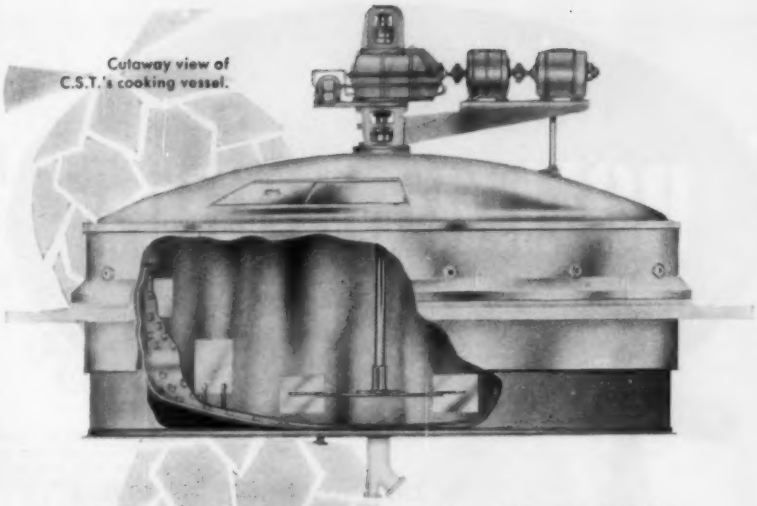
G. W. Ppool

Gamble will headquarter in Tulsa under the direction of R. A. Brewer, division manager. Ppool, former assistant district manager for the Kansas area, will headquarter in Great Bend, Kans. Gamble joined Continental-Emsco in 1951 as a salesman.

The J. B. Beaird Co. realigns

John Hendryx

. . . its staff in general products sales, according to Gerald Pope, general manager of sales. John Hendryx has been promoted from product manager to manager of the compressor sales. Operations of the special products division and the storage and contract section has been consolidated under the direction of J. S. Richey, who has been named manager of contract sales. Activities of both contract sales and compressor sales will be under the



Cutaway view of C.S.T.'s cooking vessel.

What's New at C. S. T.?

C.S.T.'s new space saving "Dual Paraboloid" fermenting tank.

The vessels illustrated here are new for the brewing industry. They have helped increase production from a few barrels a day to many times that, yet the "Old World" brewmasters quality has been retained.

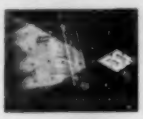
The same ingenuity and know-how that developed and fabricated these designs for this industry can be applied to your problem . . . whatever it may be.

In the petroleum and petro-chemical fields, C.S.T. has been turning out tanks and vessels—of all types, in all sizes and shapes—since 1899.

When you need equipment for your particular process, investigate the savings in time and money C.S.T. engineers can bring about for you. We're equipped to handle your complete requirements.

Our Most Important Products—QUALITY and SERVICE.

Write for your personal copy of the brochure describing C.S.T.'s facilities.



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ROLL-A-GROOVE
FOR GROOVING THE NEW, ECONOMICAL
LIGHT WALL STEEL OR ALUMINUM
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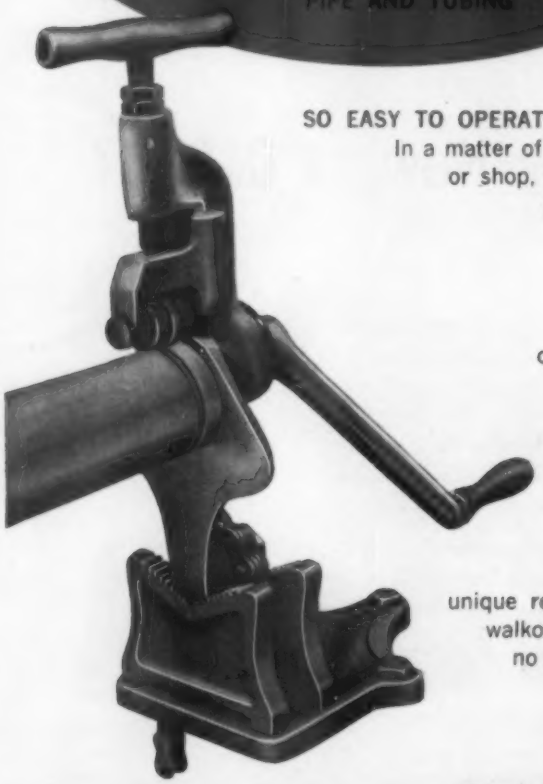

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In a matter of seconds, in the field or shop, by hand or power, a groove can be rolled in 2" to 6" IPS light wall pipe.

RUGGED . . .
cast of malleable iron for complete portability and long trouble free usage.

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unique roller design prevents walkoff and slippage . . . no groove measuring or gauging required.

For Use with G-B Gruvagrip, Gruvajoint, Rigi-Grip or Other Similar Grooved Pipe Couplings and Fittings.

Does Not Weaken or Work Harden Pipe Ends. Under Extreme Pressure This Pipe Burst, But Grooved Ends Did Not Shear Off or Swage Down.

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GUSTIN-BACON Manufacturing Company
210 W. 10th St., Kansas City, Mo.

direction of W. W. Sentell, manager of the general products sales division. Storage and contract sales were formerly directed by R. W. Rademacher, who has been promoted to manager of the new eastern division in New York.

Baker Oil Tools, Inc., names

. . . E. H. Clark, Jr., as vice president and assistant general manager, to carry out assigned administrative functions at Los Angeles. He formerly was head of the research department.

E. H. Clark, Jr.

W. S. Althouse, Jr.

W. S. Althouse, Jr., recently elected a member of the board of directors, was named manager of engineering and research. He formerly held the title of chief engineer. G. D. Hall, assistant secretary-treasurer, and formerly assistant manager of the central division, was appointed administrative director of the Houston plant.

George E. Matter named

. . . executive vice president and general manager of Homco International, C. A. In his new position, he will direct all entities of the company with offices and warehouse facilities in Los Morochas, Ven. He began his tenure of duty with Homco as a directional drilling engineer in Corpus Christi, Tex., in 1941. Later he transferred to Bakersfield, Calif., as district manager.

R. E. Story named manager

. . . of Bucyrus-Erie Co. of Canada, Ltd., Guelph, Ont., a subsidiary of Bucyrus-Erie Co. He was manager of the Chicago works from September 1956 until its closing earlier this year. He then became assistant to the manufacturing manager at the South Milwaukee works. He joined the company in 1947 as a special apprentice.

This is not an offering of these securities for sale, or an offer to buy, or a solicitation of an offer to buy, any of such securities. The offering is made only by the prospectus.

The Houston Corporation

$36,188,000
5% Subordinated Debentures due August 1, 1968

1,809,400 Shares
Common Stock
(Par Value $1 per share)

Offered only in Units each consisting of $100 principal amount of Debentures and 5 shares of Common Stock, which will not be separately transferable prior to August 15, 1959 or such earlier date as the Company may elect. The Company has agreed with Blyth & Co., Inc. and Lehman Brothers that it will not make the Debentures and Common Stock separately transferable prior to March 15, 1959 without their consent.

Price $150 Per Unit
plus accrued interest on the Debentures from August 1, 1958

Copies of the prospectus may be obtained from any of the several underwriters only in states in which such underwriters are qualified to act as dealers in securities and in which the prospectus may legally be distributed.

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E. F. Hutton & Company — **Reynolds & Co.** — **L. F. Rothschild & Co.** — **Shields & Company**

F. S. Smithers & Co. — **Spencer Trask & Co.** — **Tucker, Anthony & R. L. Day** — **G. H. Walker & Co.**

August 20, 1958.

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$68,200,000
Houston Texas Gas and Oil Corporation
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August 20, 1958.

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- Extra weight and balance for "non-wobbling" falls.
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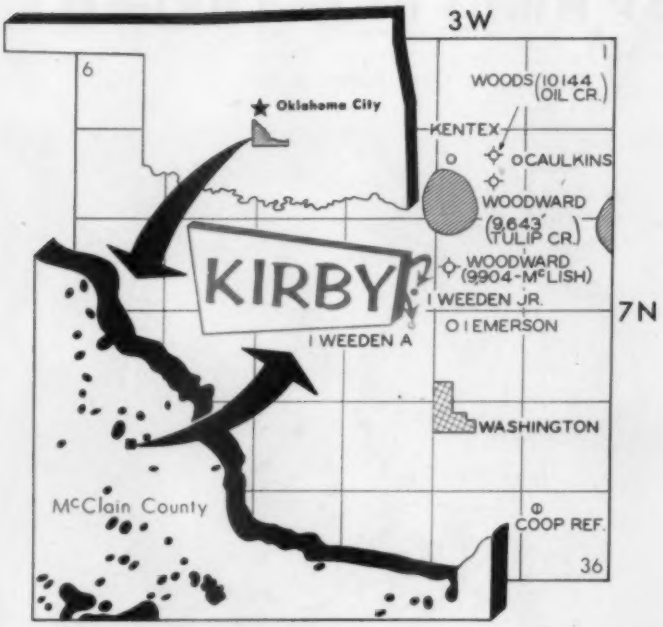


A NEW FIVE-PAY FIELD has been uncovered in McClain County, Oklahoma, at Kirby Petroleum Co.'s 1 Weeden, Jr. The discovery penetrated four possible pay zones in Ordovician sands, and the first offset has found a fifth in the Dees-Pennsylvanian.

Two-gun approach hits multiple bull's-eye

Imagination, teamed up with dash of geophysics, pays off in Oklahoma sector

BY FRANK J. GARDNER

IN SOUTH CENTRAL Oklahoma, an independent operator has demonstrated that with a little imagination and a dash of geophysics, there's still plenty of oil to be found in and around older oil fields.

Four pay zones . . . In McClain County, Kirby Petroleum Co. has come up with a four-pay strike at its 1 Weeden, Jr., Section 15-7n-3w. It has completed the wildcat in the Oil Creek sand at 10,006-50 ft. for its discovery allowable of 150 bbl. daily, and has applied to the Oklahoma Corporation Commission for permission to make a triple completion in Oil Creek, McLish, and Tulip Creek sands, all Ordovician-Simpson in age. A fourth potential Ordovician pay, the first Bromide sand, will be left behind the pipe.

Eugene Neal, Kirby's vice president and division manager at Tulsa, attributes the discovery to a two-gun approach by subsurface geological thinking, and a seismic shooting program. A study of nearby dry holes and fields indicated that a prospective area lay hidden in 7n-3w. The seismic lines confirmed the hunch with a nice picture of structural uplift, and the Weeden wildcat was spotted. The resulting strike lies on an anticlinal fold, complicated by faulting.

On the way down, Kirby found commercial sands throughout the Simpson section. A drill-stem test on the first Bromide sand at 9,199-9,206 ft. yielded 35 bbl. per hour of 39°-gravity oil. No perforations were made here and because of the fairly thin sand section, no completion at this level is anticipated.

And no water . . . In the Tulip Creek sands at 9,496-9,573 ft., perforations flowed 159 bbl. of 39° oil in 12 hours. Still deeper, the McLish sands yielded 242 bbl. of 39° oil on a 12-hour test of perforations at 9,658-9,786 ft. Finally, the Oil Creek sand, perforated at 10,006-50 ft., flowed 162 bbl. of 40° oil in 12 hours. All tests were on small chokes, 22/64 to 24/64-in., and no water was found at any of the three levels.

Kirby carried the discovery to total depth 10,190 ft., 22 ft. into the Arbuckle formation. The company holds a 650-acre block around the well.

Immediately upon completing the 1 Weeden, Jr., drilling began at the 1 Weeden "A," a south offset in Section 22-7n-3w, and location has been made for 1 Emerson, a southeast offset in Section 23-7n-3w. The 1 Weeden "A" has already provided a surprise of its own with a new sand for the area. On a drill-stem test of the third Dees-Pennsylvanian sand at 7,962-8,026 ft., gas surfaced in 38 minutes, and recovery was 50 ft. of oil and gas-cut mud, 90 ft. of oil and mud, and 500 ft. of clean oil. Kirby is drilling the offset to its 10,200-ft. objective and now is below 8,100 ft.

Add a new field . . . This new field, promptly dubbed Northwest Washington, appropriately lies ½ mile northwest of Washington townsite. Nearest production is in the not-so-appropriately named East Washington field, ¾ mile north of the new strike. The two fields lie on separate structures and are separated by a dry hole, the Woodward & Mendota 1 Follis, a 9,904-ft. McLish failure.

Here is just one more example of what can be accomplished with a combined geological-geophysical approach to exploration in our older oil areas. How many more small but prolific and possibly multipay prospects lie hidden in **your** log files?

Blowouts and prolific wells attract national attention

Scipio—hottest thing in Michigan

BY ROBERT E. IVES

THE Scipio oil field derives its name from Scipio Township, Hillsdale County. It is located in the north central part of that county about 25 miles north of the Indiana line (Fig. 1). First oil was discovered in January of 1957 and through June of 1958, nine wells had produced 234,061 bbl. of oil.

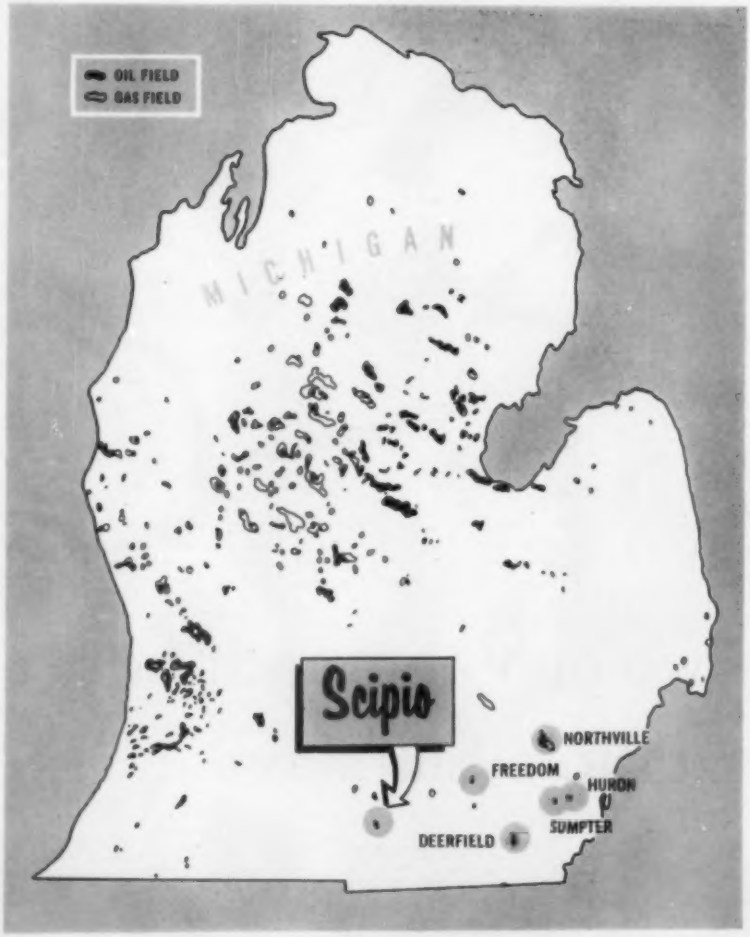
Production is being obtained from the Trenton-Black River formation of Middle Ordovician. Pays are in a secondary dolomite and confined to a fracture zone. Producing depths range between 3,770 and 3,950 ft. Nearest previous Trenton production was located about 40 miles northeast in the now-abandoned Freedom pool of Washtenaw County (Fig. 1).

At present, the field is about 1½ miles long and ½ mile wide trending in a northwest-southeasterly direction. Operators are carrying on an active drilling program and to date have not established the northwest or southeast limits of the pool.

History and Development

Only a few widely spaced Trenton tests had been drilled in Hillsdale County prior to the present development. Some of these tests were drilled as a result of gravity surveys and others as hunches or on the little surface data available. The actual discovery well was a nontechnical location between two gravity highs. This test, 1 Perry Houseknecht, NW¼ SE¼ NE¼ Section 10, spudded in May 1955. First good shows of gas were reported at 3,650 ft. in the Trenton in September 1956. It was not until January of the following year that oil was encountered at 3,776 ft. High pressures coupled with 4-in. cable tools hindered the drilling of the well which finally bottomed out at 3,900 ft. in July of 1957. Increases in oil were recorded all the way to the total depth. Initial gages ranged from 2½ to 10 bbl. of oil per hour and gas between 2 and 5 M.M.c.f.d. Tubing was run through the main gas zone and the well was completed for flowing 140 bbl. per day on a plunger lift. Before completion of the discovery well a 20-acre spacing had been established and another well completed.

The author is a geologist, Geological Survey Division, Michigan Dept. of Conservation, Lansing.



OIL AND GAS FIELDS of Michigan. Fields producing from the Trenton formation are shown in the shaded circles. Fig. 1.

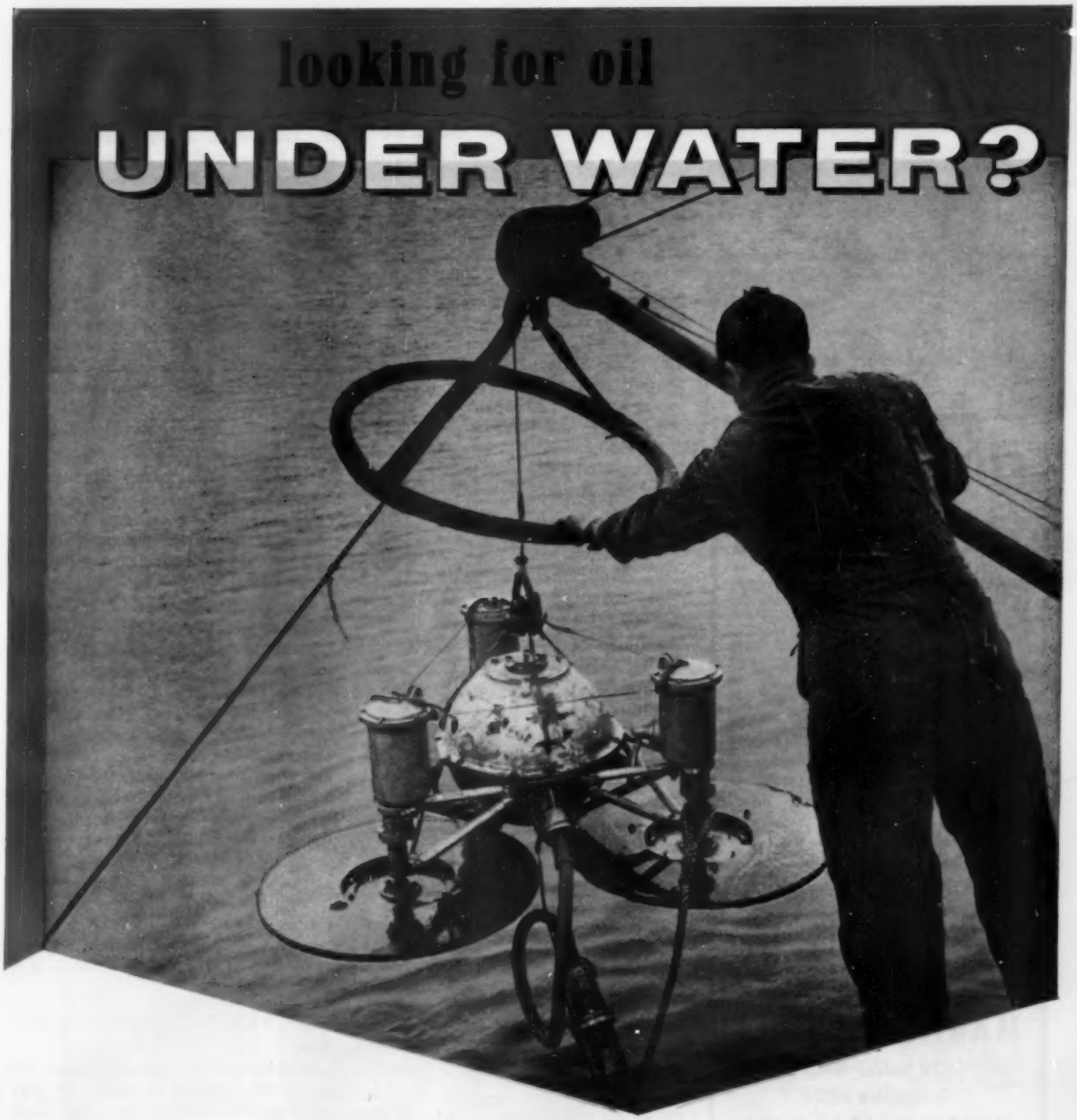
The field received national attention in September 1957 when the fourth well to be drilled blew out of control for 25 hours. Aurora and McClure's 1 Stevens, SE¼ SW¼ NE¼ Section 10, lost circulation at 3,770 ft. Operators shut the well in immediately after the zone in question was encountered. The surface began to crater and in order to save the drilling rig it was necessary to open the well. Estimates of the production were about 4,000 bbl. of oil and 15 M.M.c.f. of gas for the 25-hour period.

After successfully killing the well with salt water and running 5-in. casing, the well flowed 2,410 bbl. of oil per day on initial tests. It was later pinched to 150 bbl. per day. The gas-oil ratio was 306 and the bottom-hole pressure 1,579 psi. Development proceeded slowly with the completing of several good wells. Then in March 1958 another blowout occurred.

The Aurora and McClure 1 Haven, NW¼ NE¼ NW¼ Section 14, blew out of control for 7 hours after encountering a lost circulation zone at 3,790 ft. Mechanical difficulties were corrected and the well brought under control. Initial gages on the gas were

looking for oil

UNDER WATER?



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in excess of 75 M.M.c.f. and approximately 800 bbl. of oil flowed to the pits and on to the ground. The test was later deepened to 3,950 ft. and completed for flowing 150 bbl. of oil per day with a gas-oil ratio of 311.

As of August 4, 17 oil wells and 1 shut-in gas well had been completed. The east and west limits of the field are fairly well defined by dry holes. Operators at present are concentrating on drilling up the inside acreage and extending the southeast and northwest limits of the field.

Local Geology

The principal part to date of the Scipio Field lies in a glacial drainage way. Topography consists of a swampy river valley with rolling hills to north, southwest and east. Marshall sandstone of Mississippian age outcrops on the edges of the hills and appears to make up the core of the hill in some instances. Along the river swamp coldwater shales underlie the drift deposits. Drift thickness varies from a few feet to an excess of 200 ft. In the river channel it is between 130 and 170 ft. Elevations range from 1,020 to 1,120 ft. depending on the location to the river swamp relative to the hills. The south branch of the Kalamazoo River flows in a westerly direction through the field. A south-to-north-flowing tributary intersects the river in the approximate center of the east one-half of section 10. Unconsolidated peat deposits along the river swamp have created some problems in established locations.

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Stratigraphy

Formations drilled in the Scipio field range between Marshall of Middle-Mississippian to Prairie Du Chien of Lower Ordovician. A brief summary of the units in descending order is as follows:

MISSISSIPPIAN: (Thickness 1,116 to 1,289 ft.)

Marshall: A light gray-white sandstone. Thickness 0-40 ft.).

Coldwater: A gray shale with minor amounts of sand and limestone. A red calcareous shale is usually found near the base of the unit. Thickness 900-950 ft.

Sunbury: A black carbonaceous shale, about 15 ft. thick.

Berea-Bedford: A gray sandy shale with soft gray shale at the base. Approximate thickness 35 ft.

Antrim: A black carbonaceous shale with some thin gray units. Usually has brown or black spore cases and traces of anthracite. Approximate thickness 195 ft.

DEVONIAN: (Thickness 525 to 561 ft.)

Traverse Formation: A gray shale lensed with brown limestone, about 40 ft. thick.

Traverse Limestone: A light-brown and gray dolomite and lime unit with shale lenses, quite cherty in upper part and fossiliferous. The unit usually has some porosity. The thickness averages about 170 ft.

Dundee: A light-brown even-grained limestone which has some porosity. Average thickness is about 30 ft.

Detroit River: A brown dolomite with thin anhydrite partings. Unit has some porosity lenses and averages about 260 ft. in thickness.

Sylvania: A light-brown sandy dolomite that appears to be correlative with the Sylvania sandstone. Thickness averages about 15 ft.

Unconformity: A dark dolomite unit that is quite carbonaceous and argillaceous. It does not resemble the Bois Blanc or the underlying Bass Island-Salina beds. It is a fairly good marker if accurate sampling methods are utilized. The unit is about 20 ft. thick.

SILURIAN: (Thickness 990 to 1,015 ft.)

Bass Island: The Bass Island formation which is the uppermost Silurian deposit appears to be missing. A fairly thin, 5 to 10 ft., brown dolomite has been logged in some of the wells. This bed would be equivalent to rocks of that formation.

Salina: A series of brown dolomite beds with gray shaly dolomite lenses and thin anhydritic partings. There are no salt units present in Hillsdale County. The total thickness is only about 415 ft.

Niagaran: A gray-white crystalline dolomite which is about 450 ft. thick. Usually is quite porous in the upper section.

Cataract: A series of gray shaly and light-brown dolomites. The Cataract group is the basal member of the Silurian. Beds of possible Clinton age have been included with the Cataract because there appears to be no logical break between the units in this area. In other areas the Cataract can be easily distinguished from the Clinton by its red coloration. The thickness of the unit as described is very consistent, not varying more than 7 ft. (about 108 to 115 ft. thick). It is a very good marker bed on Gamma Ray logs.

ORDOVICIAN: (Thickness 1,870 ft. plus)

Cincinnatian Group: An upper 350 ft. of this unit is a series of gray dolomites, limestones, and shale beds. The lower part is principally gray shale. Total thickness varies between 669 ft. to 684 ft.

Trenton-Black River Formation: A gray-brown to gray limestone with carbonaceous partings and fossiliferous units. Inside the productive limits of the Scipio field this unit is almost entirely dolomite. It varies in color from brown to gray brown and is highly fractured and brecciated. The fractures have been cemented in part by white crystalline dolomite. About 350 ft. from the top of the unit is a thin, 4 ft., black carbonaceous shaly bed. This bed is very consistent and has been used as a marker to separate the Trenton from the Black River. Oil is being produced in the Scipio field

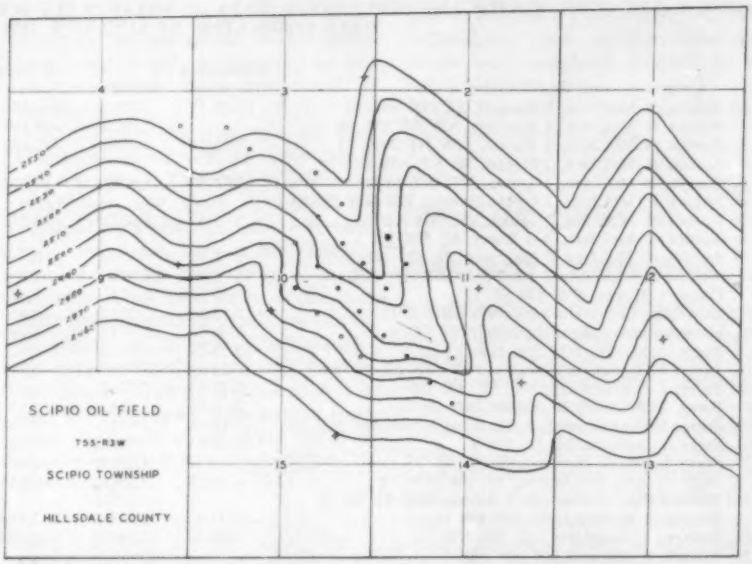
from above and below the black shaly bed. Total thickness of the Trenton-Black River in the Scipio field is about 610 ft.

Glenwood: A thin shaly unit at the base of the Trenton-Black River. Approximately 10 ft. thick.

St. Peter—Prairie Du Chien: These two formations are the lowermost beds of the Ordovician system. The St. Peter is an 8-ft. bed of sandstone or dolomitic sandstone directly underlying the Greenwood. Only about 55 ft. of the Prairie Du Chien has been drilled. It is a light-brown sandy dolomite with some chert.

Structure

The Scipio field is located on the south flank of the Michigan basin with the various formations dipping north and northeasterly between 30 and 50 ft. per mile. Detailed structure contours on the Trenton indicate a shallow syncline which plunges in a northwesterly direction (Fig. 2). The syncline is a part of a broader monoclinal-type structure which plunges to the north. The total east-west magnitude of the broader feature has not been defined in Fig. 2 because the outer limits have not been drilled to date. There is some suggestion that additional depressions may be on the broader feature. This postulation is illustrated between section 1 and 2 (Fig. 2).



STRUCTURE CONTOUR MAP on the top of Trenton formation. Location and status of the wells are indicated in Table 1. Fig. 2.

Contours on the Cataract definitely reflect the same flexure as the Trenton. Other younger formations show a slight indication of the structure. However, due to the low vertical displacement, approximately 30 ft., and the fact that the units thicken and thin between 30 and 40 ft. on either side of the flexure, it is difficult to ascertain their relationship.

Pays and Reservoir Conditions

Production in the field is directly related to the fracture zone and depends on the degree of fracturing and amount of secondary dolomitization. Porosity is of a vugular and intercrystalline type variety. Some of the fractured and brecciated zones have been completely resealed with white crystalline dolomite. For this reason,

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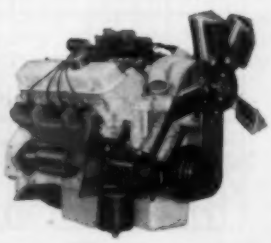

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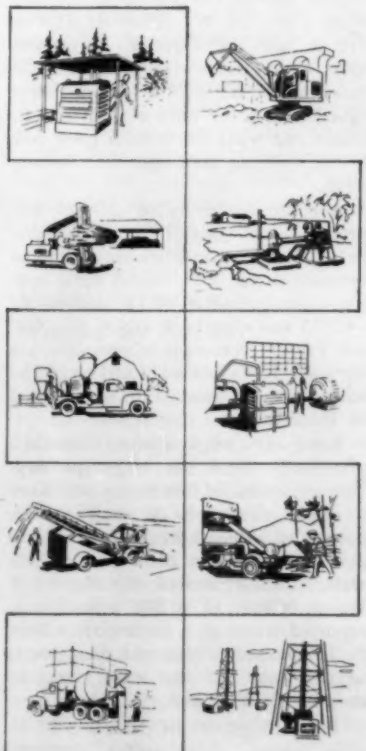


TABLE 1—LOCATION, STATUS AND STRUCTURAL DATA OF WELLS IN THE SCIPIO FIELD AREA AS DEFINED IN FIG. 2. DATA COMPLETED TO AUGUST 6, 1958

Company, well, and location—	Completed drilling	Elevation	Trenton (datum)	Total depth (datum)	Status	Present daily prod.	Gas-oil ratio, M.c.f./bbl.
1. Aurora & McClure, 1 Barnett, SE NE SW 10	11-25-57	1,028.0	—2,488	—3,170	D & A		
2. Aurora & McClure, 1 Buehrer, NW SE SW 11		2,043.0	—2,508		Drlg.		
3. Aurora & McClure, 1 Haven, NW NE NW 14	7-11-58	1,054.0	—2,490	—2,896	Oil	Flow *150	315
4. Aurora & McClure, 2 Haven, SE NE NW 14					Loc.		
5. Aurora & McClure, 1 Lattas, NW NE SE 10	2-22-58	1,022.4	—2,512	—2,836	Oil	Flow *150	316
6. Aurora & McClure, 1 Lattas-Hornczi, SE NW SE 10					Loc.		
7. Aurora & McClure, 1 Rowe, SE NW NE 10	5- 3-57	1,027.0	—2,535	—2,911	Oil	Flow *87	2,290
8. Aurora & McClure, A-1 Rowe, SE SW SE 3					Loc.		
9. Aurora & McClure, 1 Stephens, SE SW NE 10	9-18-57	1,020.1	—2,514	—2,752	Oil	Flow *125	1,598
10. Aurora & McClure, 2 Stephens, NW SW NE 10	4- 5-58	1,023.6	—2,510	—2,923	Testing	Flow 120	
11. Davis, 1 Moyer, NW SW SE 12	7-19-58	1,202.3	—2,486	—2,910	D & A		
12. Dee Drlg. Co., 1 Domack, NW SE NE 15	12-15-57	1,053.5	—2,456	—2,871	D & A		
13. Houseknecht, 1 Kintigh, NW NW SW 9	5-30-58	1,018.0	—2,495	—3,169	D & A		
14. Perry, 1 Martin, NW SW NW 11	10- 7-57	1,024.0	—2,523	—2,906	Gas		
15. Perry, 1 Hornczi & Huraczy, NW NW SE 10	7-21-58	1,024.7	—2,509	—2,932	Testing	Flow 40	
16. Perry, 1 Houseknecht, NW SE NE 10	6-20-57	1,026.7	—2,531	—2,873	Oil	Flow *150	835
17. Perry, 2 Houseknecht, SE SE NE 10	2- 8-58	1,026.8	—2,530	—2,943	Oil	Flow *15	13,167
18. Perry, 1 Houseknecht & Thompson, NW NE NE 10	7-18-58	1,035.3	—2,546	—2,921	Oil	Flow *150	315
19. Perry, 1 Nelligan, SE SE NE 9	11-11-57	1,023.6	—2,502	—2,937	D & A		
20. Perry & Son, 1 Buehrer, SE SE SE 10		1,031.0	—2,497		Drlg.		
21. Perry & Son, A-1 Martin, SE SW NW 11	8- 6-58	1,032.1	—2,516	—2,918	Testing	Flow 132	
22. Perry & Son, 1 Omstead & Lattas, NW SE SE 10		1,029.0			Drlg.		
23. Rovsek, 1 Buehrer, NW SW SW 11	12-31-57	1,041.8	—2,514	—2,910	Oil	Flow 150	1,201
24. Rovsek, 1 Dougherty, SE SW SW 11	3-20-58	1,045.9	—2,504	—2,948	Oil	Flow 150	290
25. Rovsek, 1 Gillespie, SE NW SW 3					Loc.		
26. Rovsek, 1 Karr, NW NE NE 14	3- 9-58	1,151.2	—2,475	—2,894	D & A		
27. Rovsek, 1 Staelens, NW NW SE 11	5- 9-58	1,077.0	—2,498	—2,917	D & A		
28. Rovsek, 1 Wood, NW SE SW 3	5-24-58	1,031.8	—2,544	—2,964	Oil	Flow 36	276
29. Rovsek, 1 Wooden, SE NE SE 4					Loc.		
30. Sharpe, 1 Fowler, SE SE NE 3	12-19-57	1,130.0	—2,552	—2,955	D & A		
31. Union Dev. Co., 1 Jenrow, SE NE SE 10	4-28-58	1,029.8	—2,515	—2,937	Oil	Flow *120	479
32. Union Dev. Co., 2 Jenrow, NW NW SW 11	6- 3-58	1,034.2	—2,526	—2,931	Oil	Flow *150	300
33. Union Dev. Co., 3 Jenrow, SE NW SW 11	7-21-58	1,036.8	—2,516	—2,918	Oil	Flow *150	204

*Wells prorated at 150 bbl. per day and/or 200 M.c.f. of gas.

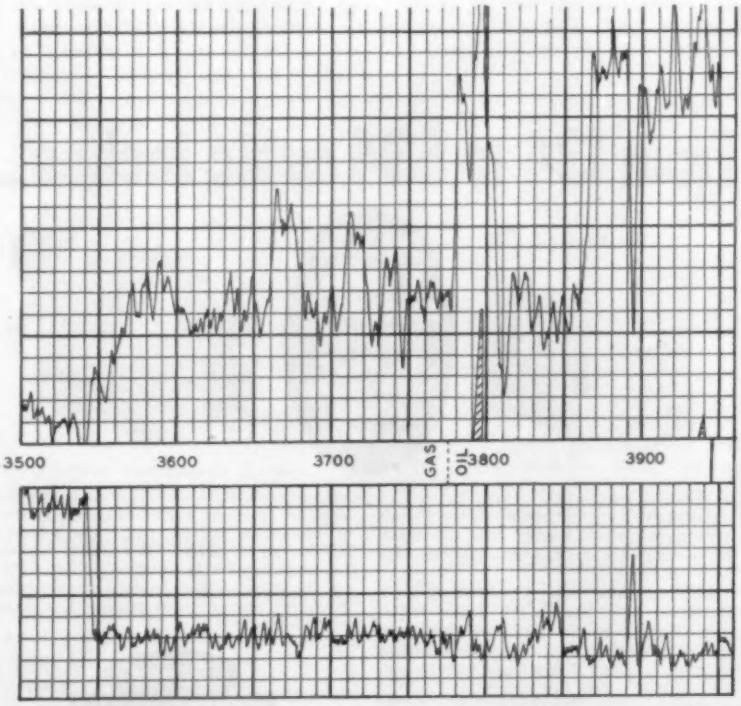
pays are erratic and only general statements can be made.

Gas has been recorded from the top of the Trenton to 280 ft. in, or a −2780 datum. Oil has been recorded from a −2730 to −2900 or 210 to 410 ft. into the Trenton. At present most of the wells are producing oil from below a −2750 datum. Pays have been in the nature of 2 to 8-ft. lenses and what has been a good pay in one well has been tight in offsetting wells.

Average accumulative oil pay will probably not exceed 30 ft. for the field. Average porosities are estimated between 4 and 8%. Initial static bottom-hole pressure at a datum of −2873 was slightly in excess of 1,600 psi. Present bottom-hole pressures are between 1,405 psi. to 1,601 psi. The daily prorated production is recorded in Table 1.

Reservoir energy is being furnished principally from the large gas cap. The utilization of this energy will have a direct effect on the ultimate recovery of oil for the field. There is also an indication of a bottom-hole water drive. One well, the Rovsek 1 Wood, NW¼, SE¼ SW¼ Section 3, reported water at a datum of −2954 ft. It is expected that the other wells in the field will cut water later in their production history.

The API gravity of the oil is 38.5° with about .2% sulfur content.



REPRESENTATIVE gamma ray-neutron logs of the Trenton-Black River producing section in the Scipio field. Fig. 3.

Specific gravity of the gas is .753 with a B.t.u. factor of 853.

Drilling and Completion Practices

A combination rotary and cable-tool program is being carried on in the Scipio field. Most of the wells have been rotaried from the surface to 20 or 200 ft. into the Trenton. A surface string is being set at approxi-

mately 550 ft. and cemented to the surface. The long string, either 5-in. or 7-in. casing, is set in the Trenton and the hole spudded in. On the wells where the long string has not been set through the gas zone a liner is run. After running tubing, operators have installed a plunger lift. The wells are completed as flowing at the prorated rate of 150 bbl. and/or 200 M.c.f.d. of gas.

Four wells have been treated in the field. Of these four, two were acidized, one shot with nitroglycerine and one sand-fractured. Only the sand-fracture job was a noticeable success. This well Aurora and McClure's 1 Stevens, NW¼ SW¼ NE¼ Section 10, reported only a small show of oil initially. After the sand-fracture it flowed as high as 170 bbl. of oil per day.

The field is being drilled on a 20-acre spacing pattern with the wells being located in the southeast and northwest quarters of a standard 40-acre unit. Gamma-ray and Neutron logs have been run on several of the wells. One 5-ft. core was taken on a marginal well. Recently Aurora and McClure have started and are carrying out a coring program. The Buehrer 1 in the SE¼ SE¼ SW¼, Section 11, is the first well on this program. Information is not available on the cores to date.

Aurora Gasoline Refining Co. of Detroit and Gladieus Refining Co. of Fort Wayne, Ind. are purchasing the oil, at a price of $2.81 per barrel. The oil is being transported by trucks to the refineries.

Production

A substantial increase in the field can be expected during the months of July and August in 1958 as several new wells were added to the field. It is estimated that by September 1 the field will be producing in excess of 2,000 bbl. of oil per day.

The variable nature of the reservoir rock in the Scipio oil field would make it impossible to estimate recovery on the basis of volume content. However, the performance of the wells in the field does give an indication of the well potential. Estimates on the above basis would place the ultimate yield per acre in excess of 12,000 of oil for the present productive limits of the field.

Future Possibilities

Approximately 380 acres have been proven productive in the Scipio field. The northwest and southeast limits of the fractured zone have not yet been defined. Even without a notable extension the field is by far the best Trenton oil field in the state. Moreover, on an individual well-performance basis, it will undoubtedly be one of the better fields discovered in Michigan.

Exploration for the type of field discussed above will be both costly and hazardous. The low differences in relief are not easily depicted on regional contours. In other Trenton producing areas, such as the Freedom and Northville field (Fig. 1.), the fracture zones have been directly related to good structures with reliefs up to 400 ft. in ¼ mile. Undoubtedly, the present development will lead to additional Trenton exploration in southern Michigan. Information from these tests will be of great value in interpolating the structural geology of that region.

Precambrian tested in New Mexico

PLANS for a Precambrian test in Valencia County, eastern New Mexico, have been announced by Richard King, Jr., of McAllen, Tex. Scheduled depth is 5,500 ft.

The project will be drilled as 1 Wilson Heirs. Exact location had not been staked, but it is expected to be near Section 13-7n-3w, which is 30 miles southwest of Albuquerque and 22 miles west of Los Lunas.

This location is on the North Lucero anticline. It will earn for King a 10,000-acre lease in the southwest corner of the Antonio Sedillo Grant. Nearest exploration is Gore & Lipson Oil Producers 1-B Federal, Pennsylvanian wildcat, 8 miles to the southwest.

Oklahoma's Harper gets new strike

A NEW productive zone at the second well in a recently opened pool in Harper County, northwestern Oklahoma, has been discovered by Sinclair Oil & Gas Co.

Sinclair's 1 Kuhn, NW SE 6-28n-22w, flowed an estimated 40 bbl. of oil an hour on a 55-minute drill-stem test of the basal Kansas City lime at 5,211-55 ft. Gas surfaced in 2 minutes and flowed at the daily rate of 683 M.c.f. in 5 minutes; mud surfaced in 33 minutes and oil in 35 minutes. Crew was pulling tester from hole.

The well previously flowed oil on a drill-stem test of the Lansing lime at 4,560-4,605 ft.

The 1 Kuhn is ½ mile north-northeast of Sinclair's 1 Holcomb, NE NW 7-28n-22w, rank wildcat discovery which was completed recently as an Arbuckle lime strike.

The Kansas City lime was not tested in the discovery well.

Wilcox pays in eastern Louisiana

WILCOX EXPLORATION in eastern Louisiana's parishes accounted for another discovery last week, and the confirmation of another discovery that was made a year ago.

The new discovery is about a mile south of Clayton field, about 4 miles southeast of Clayton, in northeastern Concordia Parish, and about 5 miles from the Mississippi River.

The discovery is by R. A. Campbell at his 1-A Turner, which flowed 37 bbl. of oil per day from Wilcox perforations at 5,061-64 ft. Flow is under pressure of 160 psi. with gas-oil ratio of 300 cu. ft. per bbl. Bottom of hole is 6,000 ft.

In Catahoula Parish, about 20 miles northwest of the Concordia discovery, Olin Oil & Gas Corp. confirmed the discovery of Wilcox production made by Durbin Bond & Co., Inc., at Mean Lake last September. Olin's well, 1 Tensas Delta-Monaghan, 1,050 ft. west of Durbin Bond's discovery well, flowed 153 bbl. of 35°-gravity oil per day through ⅛-in. choke. Its pay, in hole drilled to 5,023 ft., is perforated at 4,389-90 ft. The discovery well, perforated at 4,371-73 ft., flowed 165 bbl. of 43°-gravity oil per day through 5/32-in. choke.

The field is about 5 miles southeast of Harrisonburg, nearest other production. A previous attempt to confirm the discovery got a dry hole.

Montana review offered by Society

"Montana Oil and Gas Fields Symposium 1958," prepared and edited by the symposium committee of the Billings Geological Society, has just been released.

This fine work represents a systematic review of 61 oil and gas fields in Montana. It incorporates structure contour maps, a typical electric log for each field, statistical data, and limited use of isopach maps and cross-sections.

Also included are several feature articles. This volume is a valuable and useful addition to the library of any Rocky Mountain exploratory enthusiast.

Drilling begins at Maritime site

DRILLING is getting under way on a new wildcat test in New Brunswick, a far-eastern Canadian Maritime province.

It is a joint operation of Imperial Oil, Ltd., and New Brunswick Oilfields, Ltd., on acreage Imperial recently acquired from its partnership company. It is Imperial's first exploratory venture in this part of Canada.

The operation is designated as Imperial-New Brunswick Oilfields-Gautreau 1 Yvon Melanson. Location is in the Dover area, east of Stoney Creek field, and 12 miles southeast of Moncton. It is near the eastern border of the province, fronting on Newfoundland Strait.

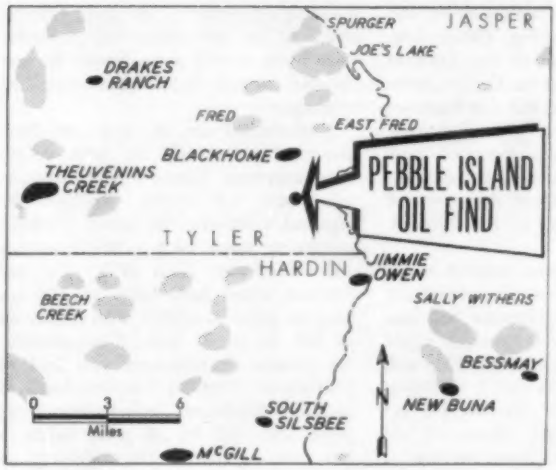
Cable tools are being used.

California drill opens new field

A NEW-FIELD DISCOVERY is reported in northern Los Angeles County, California. It is in the Val Verde area, about 1½ miles south of Castaic Hills field. Nearest production is a subcommercial well about a mile east.

Discovery is by Humble Oil & Refining Co. at its 1 Mable E. Strawn, completed on the pump for 130 to 135 bbl. daily of net new oil. Total lift is 260 to 265 bbl. of oil, of which about 50% is heated injected oil. The new oil is a viscous 18.5°-gravity crude, cut 4% with b. s. & w., which requires heating to produce.

Production is from a Miocene Tar section perforated at 5,573-98 ft., 5,612-77 ft., and 5,692-5,800 ft.



TYLER County has produced a series of recent oil and gas finds in the past year.

Texas' Tyler draws attention

ANOTHER new field opened last week in southeastern Tyler County, in southeastern Texas, draws added attention to an area marked by a long succession of oil and gas discoveries during the past year.

The latest discovery is about 3 miles southeast of Fred where Oil Reserves Corp. has a good Wilcox producer. Discovery well, 2-K Kirby-Slaughter, is the operator's third test on its 2,485-acre lease in the W. F. Slaughter Survey.

Completion of the well is from a casing-perforated interval at 8,894-8,907 ft. in hole drilled to 10,370 ft. Its flow through 5/32-in. choke was at the rate of 200 bbl. of 50.8°-gravity oil per day with pressure of 2,500 psi. and gas-oil ratio of 3,838 cu. ft. per day.

Location of the discovery, designated by the operator as Pebble Island field, is about 4 miles out of the county's southeast corner, which also is the northeast corner of Hardin County, and the juncture of the Tyler-Hardin county lines with the west line of Jasper County.

The new field is the ninth to be found in the three counties within a 15-mile radius of the above corner during the past year and a half. It is the third this year, since April, including Jimmie Owen field, in northeastern Hardin County, and New Buna field, in Jasper County. The latter is a new Yegua discovery (last June) by Cooper Petroleum Co. in the old Buna area where production had been depleted. Jimmie Owen field, discovered in April, by J. P. Owen, is productive from a 6,600-ft. Yegua sand with three wells now completed.

Other comparatively new fields, discovered in 1957, include (see map). Blackhome, Theuvenins Creek, and Drakes Branch, in Tyler County; McGill and South Silsbee, in Hardin County; and Bessnay, in Jasper County. Most important so far has been Theuvenins Creek, where eight wells have been completed to date from Wilcox sands at 8,400 to 8,500 ft. They include three completed dually. It was discovered by Sinclair Oil & Gas Co. last October. Oil Reserves and Carnes Weaver also have been active operators.

Oil Reserves Corp. also is the discoverer of Blackhome field, about 2½ miles north of its latest discovery. There, it has completed four Wilcox wells to date in two zones from 8,800 ft. to 9,000 ft.

DeQuincy field marks second well

THE SECOND WELL for Sunray Mid-Continent Oil Co.'s new West DeQuincy field in southwestern Beauregard Parish, South Louisiana, is productive of gas and condensate from a shallower sand than the Cockfield oil pay of the discovery well, completed last December.

Production is from casing-perforated interval at 8,988-9,003 ft. with flow, through 9/64-in. choke, at the rate of 1,800 M.c.f. of gas and 126 bbl. of 50.8°-gravity condensate per day.

Location of the well (3-B Lutcher-Moore) is northwest of the discovery well (2-B), completed at 9,485-92 ft. Sunray's fourth well, now drilling, is 1½ miles west of the discovery producer. Its initial test was dry at 9,995 ft.

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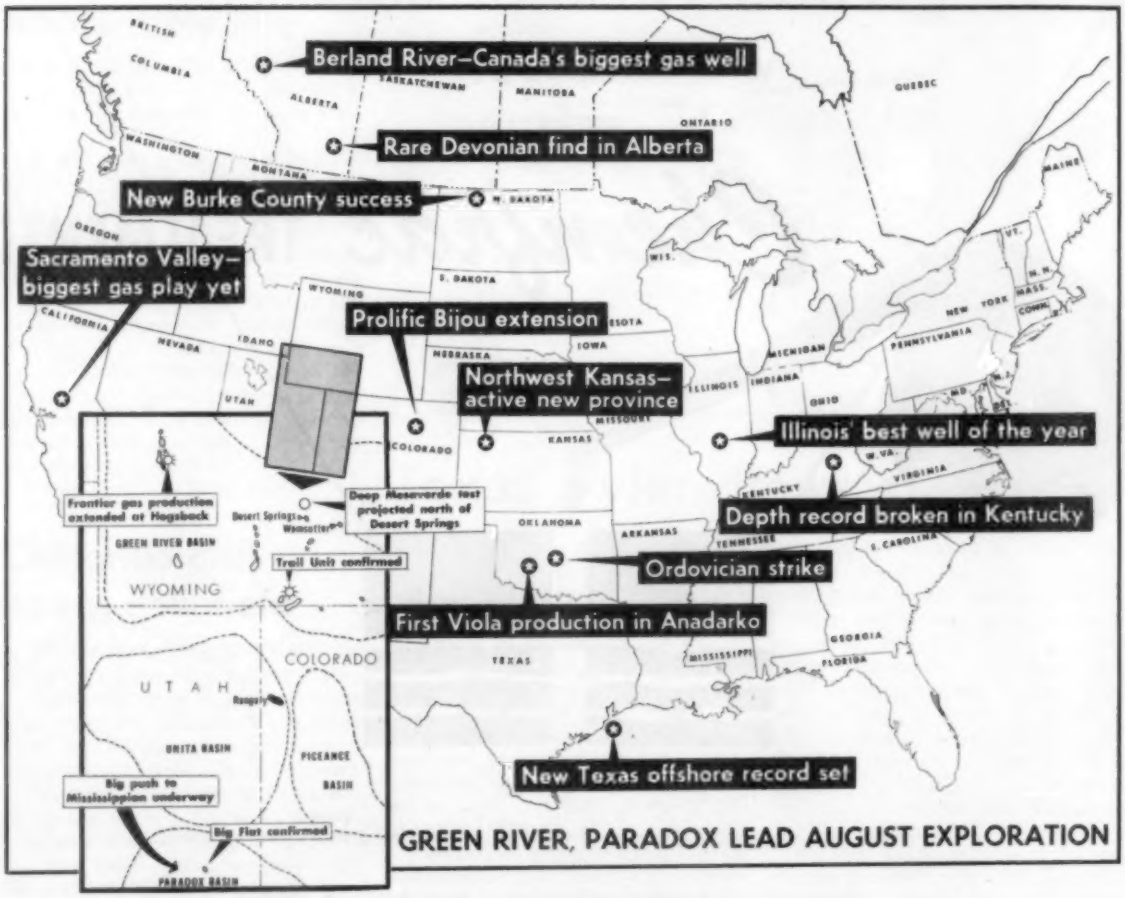

Berland River—Canada's biggest gas well
Rare Devonian find in Alberta
New Burke County success
Sacramento Valley—biggest gas play yet
Prolific Bijou extension
Northwest Kansas—active new province
Illinois' best well of the year
Depth record broken in Kentucky
Ordovician strike
First Viola production in Anadarko
New Texas offshore record set
Frontier gas production extended at Hogback
Deep Mesaverde test projected north of Desert Springs
Trail Unit confirmed
Big push to Mississippian underway
Big Flat confirmed
GREEN RIVER, PARADOX LEAD AUGUST EXPLORATION

Despite a month for records everywhere,

Green River and Paradox

draw the drillers' rigs

BY JOHN C. McCASLIN
District Editor

TWO Rocky Mountain basins, the Green River and the Paradox, figured boldly in August wildcat events. Increased gas exploration and prolific development wells in established Green River fields, plus the fast-growing hunt for Mississippian oil production in Utah's northern Paradox basin were accompanied by important discoveries, depth records, and record completions in California, Texas, Oklahoma, Illinois, Kansas, Colorado, Alberta, Kentucky, and North Dakota.

The Green River push . . . Southwestern Wyoming's big gas basin is entering its most important exploratory and development stage. Planned increases in market outlets for Green River basin gas and a weekly increase in exploration throughout the vast region plus prolific completions in both old and new areas place this section of the Rockies in a well-deserved lead spot on the news block. For several years the Green River basin has been on the top spot in wildcat "futuramas." Each year the oil and gas sages have said this is it for the Green River country. Now it appears the basin is really on its way to becoming a leading gas producer with high promise of being an oil producer of importance also.

. . . August highlights. Confirmations at Trail Unit and Desert Springs set the pace in the basin.

- Mountain Fuel Supply Co. confirmed the 4-year Trail Unit with a well that flowed 35 M.M.c.f.d. of gas from the Mesaverde-Cretaceous.
- El Paso Natural Gas Co. completed 4 Desert Springs Unit in Sweetwater County for 15,600 M.c.f.d. of gas from the Lewis-Cretaceous, confirming the 2 Unit Lewis discovery. This field also produces from Mesaverde. Its discovery last winter was hailed as one of the basin's most significant strikes in recent years.
- Other Green River basin happenings include Belfer Natural Gas Co.'s Frontier gas extension discovery at Hogsback in Sublette County. This 1-mile west extender flowed about 6 M.M.c.f.d. of gas.
- A remote wildcat was announced by Ohio Oil Co. about 15 miles north of Desert Springs. Ohio will take the test to 10,085 ft. for a look at the

Mesaverde. A strike here could really put the heat on the Red Desert basin portion of the Green River country.

Utah's Mississippian . . . Four Corners-Intermountain exploratory interest is currently centered in the northern Paradox basin. The reason is the increased search for Mississippian production in Utah. A dozen wildcats in the area are probing Mississippian depths. August events included confirmation at Big Flat, the only Mississippian producing area on this side of the Rockies, and a long list of new Mississippian wildcat projections.

● Big Flat. Pure Oil Co. confirmed oil production at Grand County's Big Flat Unit. The discovery well in this field, completed last autumn, flowed 319 bbl. of oil per day, opening first Mississippian production in Utah and on the west side of the Rockies.

Projected wells . . . Continental Oil Co. has a 13,700-ft. Mississippian test planned for Colorado's Montrose County on the Paradox Valley anticline. This is the first such wildcat in this section . . . Carter Oil Co. is drilling at 3 Nequoia Arch Unit in Emery County, Utah . . . Superior has one going in Utah's Salt Wash Unit . . . Cabeen Exploration Co. has a tight hole in the Mississippian near Big Flat . . . Superior Oil Co. has a Mississippian test planned 40 miles northwest of production in Emery County . . . Argo Oil Co. will drill one in Wayne County . . . Standard Oil Co. of California plans a Mississippian well on the Bert Mesa Unit in Wayne and Garfield counties. These wells are but a part of the growing list of wildcats planned or under way in northern Paradox basin —all with the same objective, the Mississippian.

The Regional Picture

Not all of the August wildcat events were in the Four Corners area and Green River basin. The month saw new depth records, important discoveries, and intensified drilling activity in many sectors.

. . . Berland River. Canada's deepest producer became the most prolific single gas discovery in the nation. British American et al A-8-4 Berland River flowed 45 M.M.c.f.d. of gas on restricted choke from the D3 Devonian. The open-flow potential of this well is estimated at 400 M.M.c.f.d. Berland River is also the thickest and deepest reef ever found in Canada.

. . . Texas offshore. Texas' second offshore field to be tapped this year and the farthest from shore is a Miocene gas-condensate producer. Standard Oil Co. of Texas found production at its High Island area wildcat, 19 miles offshore from Jefferson County in Federal Tract 140-L, 27 miles east of Galveston.

. . . Denver basin. The highly successful Bijou area in Morgan County, Colorado, added a big one in August. Williamson, Kissinger, and Strain 1 Schaefer flowed 1,752 bbl. of oil per day on test of the "D" Dakota-Cretaceous sand at Bijou, confirming the field which had one gas well. Bijou's discovery set off a big play in this area that resulted in big wells at West and North Bijou fields.

. . . Illinois. Reeter & Hirstein 2 Levi Montgomery flowed 2,000 bbl. of oil daily, natural, from Silurian rocks to give the state's best well this year. Location is 2 miles south of Mount Auburn in Christian County.

. . . Oklahoma. The scene of a prolific new Ordovician trek in south-central Oklahoma is the Washington area of McClain County where Kirby Petroleum Co. found 300 ft. of pay in the first Bromide sand at 1 Weeden. Oil flow on tests was 50 bbl. hourly.

. . . Anadarko basin. First Viola production was opened in this big basin at a wildcat in Caddo County, Oklahoma. Cities Service Oil Co. 1 Weidenmaier flowed 20 bbl. of oil per hour from the Viola.

. . . Northwest Kansas. This new oil province is getting busier by the week. At least three companies are busy drilling in the region looking for oil in a hunt that was set off by Phillips Petroleum Co.'s recent Llanos field discovery in Sherman County. The extension well to this Pennsylvanian field swabbed 15 bbl. of oil per hour from the Lansing-Kansas City. The discovery well had production in the Cherokee and several other Pennsylvanian zones were possible pay sands.

. . . Williston. Pioneer Oil Co. swabbed 260 bbl. of oil per day at an indicated discovery 2 miles northwest of Bowbells, North Dakota, opening a new Mississippian area for Burke County more than 5 miles from production.

. . . Kentucky. The Bluegrass State has a new drilling-depth record. United Fuel 28 Fordson Coal Co., a Leslie County wildcat in the Appalachian section of Kentucky, went to 9,432 ft., breaking the former record of 8,821 ft. at Shell Oil Co. 1 Davis in Crittenden County.

. . . California. The Sacramento Valley is in the midst of its biggest gas campaign yet. More than a dozen important wildcats are busy looking for new gas reserves in the northern California valley area.

. . . Alaska. The Deep Creek Unit wildcat on the south end of Kenai Peninsula went to 14,221 ft. to become our newest state's deepest hole. Standard Oil Co. of California drilled the test.

Second try hits Texas' Ellenburger

COMPLETING its second well in the Brown-Bassett field area of northeastern Terrell County is Magnolia Petroleum Co. The field opener had a thick, gas-bearing section in the Ellenburger, but was completed in the Fusselman due to mechanical troubles. Magnolia's second attempt completed in the Ellenburger.

No. 2 Brown-Bassett flowed 68,500 M.c.f.d. of gas from an open-hole section in the Ellenburger at 14,300-14,700 ft. Top of the Ellenburger was 14,052 ft. on elevation of 2,449 ft. Other formation markers were the Strawn at 11,733 ft., Devonian 12,270 ft., and Silurian at 12,682 ft.

Location of 2 Brown-Bassett is Section 216, Block Y, TCRR Survey. It is 1½ miles south of the field discovery.

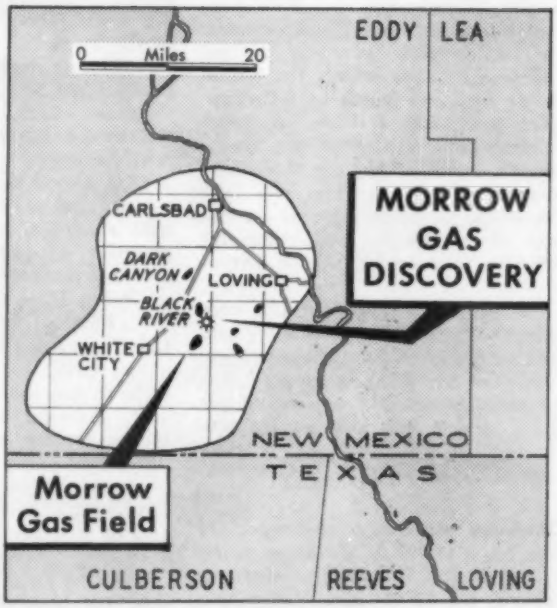
Magnolia has scheduled another extension try in the new field, this time approximately 2 miles northwest of the discovery. The 1 Bassett Mineral Trust is located on a 2,146-acre lease in Section 228, Block Y, TCRR Survey. Projected depth is 14,800 ft.

Richardson & Bass 1 Goode Estate, Section 6, Block R, TCRR Survey, indicated long northwest extension to the Brown-Bassett discovery, had gas on two tests in the Ellenburger. At 14,387-14,603 ft., gas was gaged at the rate of 4,915 M.c.f.d., and at 14,603-14,803 ft., the flow was 2,840 M.c.f. Flowing pressure on the latter test was 1,415-1,780 psi., increasing to 6,905 psi. when shut in. Operators were running electrical logs at last report.

Richardson & Bass 1 Goode is nearly 2 miles northwest of the Brown-Bassett discovery, and is running approximately 300 ft. high to that well, on the Ellenburger.

Other prospects in the area are Continental Oil Co. 1 Brown-Bassett, Section 227, Block Y, TCRR Survey, which had drilling under way last week. Projected depth is 16,000 ft. Gulf Oil Corp. has announced location for a 15,200-ft. test 4 miles south of Brown-Bassett field, in Section 45, Block 1, TCRR Survey. It is designated 1 R. W. Prosser.

TEXAS' Winkler County has a double hit, in Emperor field, and a Bone Spring discovery near Leck field.



NEW MEXICO'S Eddy County is the site of a new Morrow gas discovery prospect by British-American Oil Producing Co.

Southwest scores success

In West Texas

THE ACCOMPANYING map shows location of Cities Service Oil Co.'s recent Bone Spring discovery west of Leck field in northwestern Winkler County, and to the south, in the Emperor (Ellenburger and Devonian) field, Pan American Petroleum Corp.'s 5-T-89-C, a new-pay discovery.

Cities Service's 1-B Tubb was reported completed last week. Potential was 156 bbl. of oil a day from pay at 9,767-76 ft., plus a high gas-oil ratio. The Bone Spring formation has yielded many encouraging shows in tests throughout the Delaware basin, but few commercial producers.

Nearest Bone Spring production is about 25 miles to the northwest at Bell Lake field, Lea County, New Mexico. Probably the best Bone Spring producer to date, or at least having the highest initial production, was Sinclair Oil & Gas Co.'s 1 State-Lea 403, south of the Vacuum area in Lea County. This well was completed earlier this year for 477 bbl. of oil a day through small choke.

Pan American Petroleum's well in Emperor field had good prospects of adding Permo-Pennsylvanian pay to Devonian and Ellenburger. While drilling, tests between 7,888-7,932 ft. produced gas at the rate of 10,166 M.c.f.d. through ¾-in. choke. Other tests flowed gas in the Fusselman and Ellenburger sections. Total depth was 11,370 ft. At last report, operators were testing on perforations at 7,846-58 ft.

In South Texas

VICKSBURG sand is proving oil-productive in a wildcat about a mile northwest of Mary Bluntzer field, in southwestern San Patricio County, South Texas.

The new discovery is by D. D. G. Gas & Oil Corp. and Armstrong & Horn at their 1 C. G. Glasscock, drilled to 6,512 ft. and being completed with pay at 6,108-10 ft.

During prepotential tests the well flowed at the rate of 10 bbl. of oil per hour through a P-32 choke. Flowing pressure was 840 psi. Gravity of the oil is 39°.

Location of the well is near the old town of San Patricio, not far from the Nueces County line (Nueces River).

In New Mexico

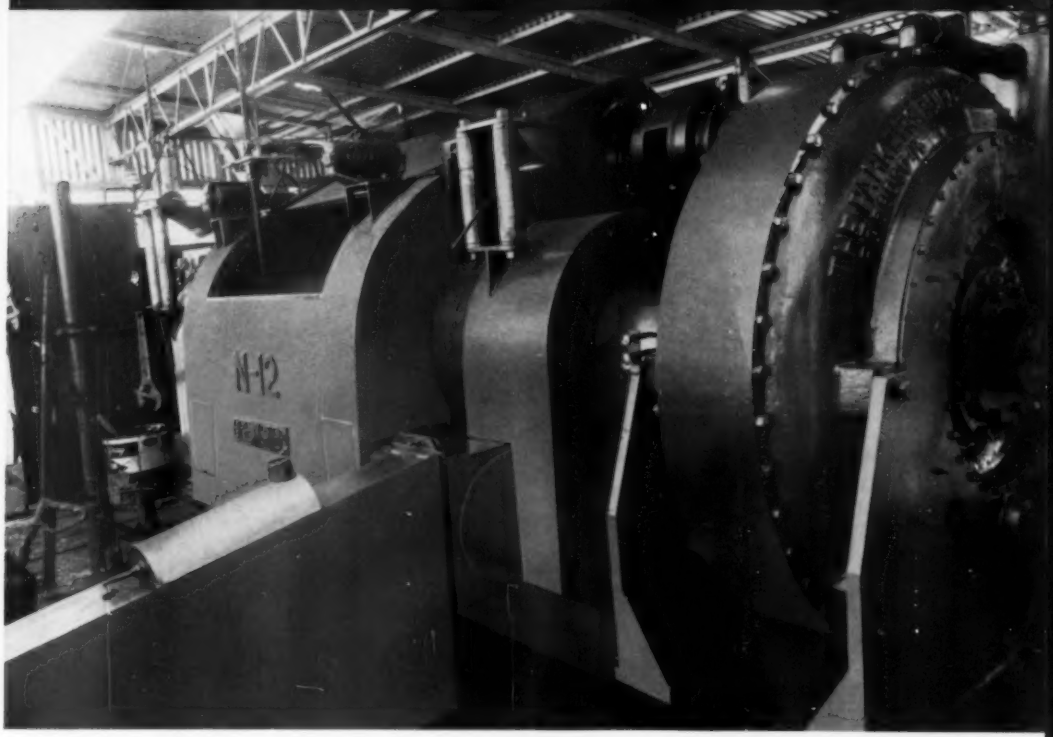
A LOT of new interest has been shown recently in the Morrow gas sands in southeastern New Mexico. The Morrow designation is new to this area. Its equivalent is the Lower Pennsylvanian Bend series.

Gas exploration has been given some stimulus by the report that Union Oil Co. has contracted to sell gas to Transwestern Pipe Line Co., beginning the latter part of 1959, for 20 cents per thousand cubic feet. Transwestern plans to build a main line across the Delaware basin, through the Malaga area en route from Texas to California, it was said.

Latest Morrow gas sand discovery prospect is British-American Oil Producing Co. 2-D Federal, Eddy County wildcat, which last week was near its projected depth of 11,800 ft., after making a number of gas flows from Morrow sand.

On test at 11,534-11,698 ft., open 3 hours and 35 minutes, the well flowed at the rate of 1,310 M.c.f.d. of gas. An earlier test at 11,534-11,620 ft. gaged approximately 1 M.c.f. per day, under flowing pressure of 730

BIG, TOUGH AND PROFITABLE



Big drum and big brakes save money and maintenance costs.

BREWSTER N-12 DRAWWORKS

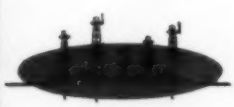
Ability to take the toughest going and still complete the hole on time has helped make the rugged Brewster N-12 number one choice of deep hole contractors like Zack Brooks. His N-12 gives him the added advantage of long trouble-free service, economical performance and utmost dependability. Here are a few of the features that will give you a profitable competitive difference when you run a Brewster N-12 on your deep work.

DESIGNED FOR 10,000 TO 20,000 FOOT DRILLING — Heavily shafted and chained the drawworks will take full rig horsepower at the drum.

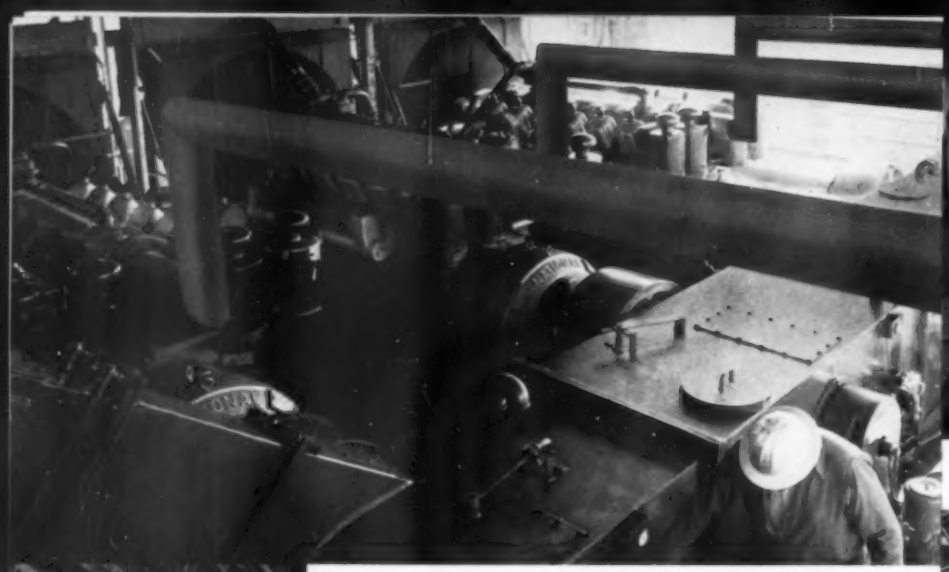
GRADUATED POWER TRANSMISSION — Four transmission speeds are combined with high and low drives at the drum to give the driller eight hoisting speeds and a reverse. Each speed is graduated to provide a 38% increase.

HEAVY DUTY COMPOUNDS — Box type or sectional for low or high speed engines.

Finger-tip simplified air controls
Dual in-line rear mounted pump drives
Portability — will move in four loads



Put yourself in a competitive position on deep hole contracts — check with Brewster on the profitable competitive difference built into Brewster Big Rigs.



Brewster oil bath rotary tables are unequaled for long reliable service.

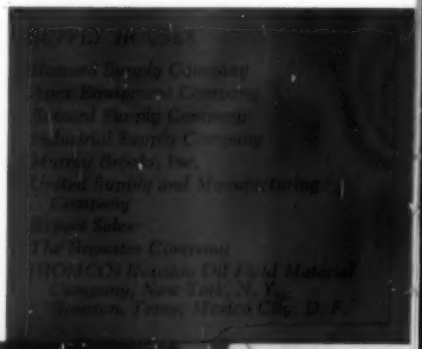
A rugged compound on the N-12 gives reliable power under heaviest loads.

For fast round trips, for time-saving drilling in any formation, get Brewster Matched Drilling Equipment. It's matched to the speed and power of the drawworks. Here's a well-balanced team to cut your drilling costs — and to bring new speed and profits to your work. The Brewster N-12 drawworks—Model 500 traveling block, the RSH 27½ oilbath rotary and the 8-SX oilbath swivel.

THE BREWSTER COMPANY, INC.
Shreveport, Louisiana

Simplified air controls add speed and safety to rig operation.

The traveling string has added dependability when it is Brewster matched equipment.



SUPPLY HOUSES

Western Supply Company
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United Supply and Manufacturing Company
Export Sales
The Brewster Company
THOMCO Division Oil Field Material Company, New York, N. Y.
Brewster, Texas, Mexico City, D. F.

SPECIFICATIONS

Recommended Available H.P.	1800
Drive Sprocket Width x Diameter	10" x 54"
Drum Core Diameter x Length	30" x 54"
Maximum Sprocket Size in Transmission	28 Teeth
Transmission Forward Speeds	4
Transmission Reverse Speeds	1
Chain	3 Duplex 14 x 12 6—2" Pitch wide
Overall Height	7'-10½"
Overall Width	9'-5"
Overall Length	27'-10"
Approximate Weight (less Hydromatic)	55,000 lbs.

In-line pump drives save time and cost in pump installing

psi. Thirty-minute shut-in pressure read 5,150 psi.

Location is SE SE 12-24s-26e, about 7 miles northeast of White City in Eddy County, and 2½ miles north of Union Oil Co.'s 1-26 Crawford, completed Morrow discovery.

Old project reentered . . . Phillips Petroleum Co. was reported planning to test the Morrow pay in a previously drilled test in southern Eddy County. The firm's 1 Guadalupe was originally drilled to 13,034 ft. as Stanolind 1 Middleton. Location is in the SW SE 20-22s-25e, 11 miles southwest of Carlsbad and 15 miles northwest of Union Oil Co. 1 Crawford.

Louisiana well opens new field

DISCOVERY of a new oil field in southwestern Evangeline Parish, South Louisiana, is reported by Sun Oil Co.

Discovery well, 1 Haas-Hirsch, in 13-6s-2w, is 3 miles south of Duralde field, nearest production. Nearest other production is in Basile field, about 4 miles south, in northern Acadia Parish.

Sun's well is rated good for 144 bbl. of 32.1°-gravity oil per day, flowing through 7/64-in. choke. Pressure is 1,275 psi., and gas-oil ratio 92 M.c.f. per barrel.

Production is from Frio sand, perforated at 7,988-96 ft.

Kansas wildcat bares new pool

A NEW OIL POOL has been opened in Stafford County, Kansas, by Sunray Mid-Continent Oil Co. at its wildcat, the 1 Cline, NE SW SE 25-24s-13w.

On final tests, the well flowed at the rate of 288 bbl. of oil a day through an 18/64-in. choke after perforations opposite two Lansing-Kansas City zones. Perforations were made from 3,594-97 ft. and from 3,698 to 3,704 ft.

The operator had drilled the hole to a total depth of 4,160 ft. and set 5½-in. casing at 3,800 ft. The higher Lansing-Kansas City zone was topped at 3,549 ft. and perforations, four shots per foot, were made from 3,698 to 3,704 ft. The hole swabbed 2 bbl. of oil an hour. The formation was acidized with 1,000 gal. of acid and the well flowed 120 bbl. of oil in 1½ hours through the 5½-in. casing after load oil had been recovered.

The hole's second pay zone was perforated, four shots per foot, and the operator ran tubing, set at 3,590 ft. This zone flowed 40 bbl. of oil an hour for 3 hours through tubing and gaged 200 M.c.f. of gas.

Sunray's wildcat producer is on a 480-block. Closest production is 2 miles west in St. John field.

Interest centers on California well

SOUTHERN Kern County's Wheeler Ridge-Tejon area continues to hold the drilling spotlight in California.

Already the possessor of an impressive discovery record, North Tejon field appears on the verge of yielding still another important find in Reserve Oil and Gas Co.'s offset to Richfield Oil Corp.'s recent Highway pool discovery.

No production figures are available, but on a test of an interval around 9,886 ft., the Reserve well (308-19 "W-T") reportedly flowed clean oil and gas at high rate. Using a 2,800-ft. mud cushion, the cushion surfaced in 30 minutes and was followed by flow of clean oil.

Because of the almost 500-ft. difference in producing depth between this well and Richfield's discovery well, Reserve is already being credited with a probable new fault block discovery.

Reserve ran 684 ft. of 5½-in. liner, with perforations at 9,899-9,989 ft., 10,019-10,105 ft. and 10,139-10,365 ft.

Elsewhere in the North Tejon-Wheeler Ridge area, these projects are active:

. . . Richfield is cementing 9⅝-in. casing at 9,692 ft. on 63-24 ROC-KCL G, a southwesterly offset to the Highway pool discovery well.

. . . Richfield is coring below 9,227 ft. on 41-24 KCL, a westerly extension of the Highway area.

Reserve is diamond coring below 11,486 ft. on 348-18, a test about midway between the Highway area and the Butler-Wehr area of the North Tejon field.

. . . Reserve is drilling below 7,538 ft. on 338-18 "BW-SP," the most easterly extension to the field.

. . . Reserve is drilling below 7,067 ft. on 302-19 "W-T," a southeasterly offset to Richfield's Highway pool activity.

At nearby San Emidio Ranch, scene of one of the state's most important discoveries in recent years, Richfield Oil is coring ahead below 11,550 ft. after cementing casing to 11,491 ft. in 81-8 KCL-H, the first extension to the San Emidio Nose field. It is about ½ mile northwest of the discovery, completed last July, which is making 390 bbl. daily of 29.8°-gravity crude through a 15/64-in. choke.

Wildcatting in California in recent weeks has been marred by a number of failures, including these more important ones:

. . . Humble Oil & Refining Co. abandoned a 4,001-ft. gas wildcat in the Pine Creek region of Butte County, about 24 miles southeast of the Corning gas field.

. . . Richfield gave up at 6,143 ft. on a wildcat 1½ miles west of production in the north Fruitvale field of Kern County just outside of Bakersfield.

. . . Royalty Service Corp., Ltd., plugged and abandoned at 5,840 ft. a wildcat about 4 miles southwest of production in the Corning gas field.

Successful Wildcats

TEXAS GULF COAST

Aransas County: Tidewater Oil Co. 1 State Tract 125, Aransas Bay (3½ miles northeast of Rockport). Shut-in gas well, tested 2,000 M.c.f. daily, ¼-in., TP 1,300 psi., perforations 9,494-5,505 ft., 9,512-20 ft., and 9,532-42 ft. (Frio). TD 9,830 ft. (New pay in Half Moon Reef field).

Chambers County: Amerada Petroleum Corp. 1-F State Tract 55, Trinity Bay. Absolute open-flow potential 10,000 M.c.f. daily, GLR 142 M.c.f. per barrel, 54.7°, shut-in TP 3,189 psi., perforations 8,732-38 ft. (Frio). TD 9,502 ft. (Discovery well South Fishers Reef field).

SOUTH LOUISIANA

Beauregard Parish: Petroleum, Inc., and J. P. Owen 1 Lutcher-Moore, 34-6s-12w. IP 77.64 BOPD, 7/64-in., 46.5°, GOR 1,352 cu. ft. per barrel, TP 860 psi., perforations 8,694-8,700 ft. TD 9,020 ft. (New pay in Fields field.)

LOUISIANA OFFSHORE

Eugene Island area: Sinclair Oil & Gas Co. 4-A OCS-0439, Block 190 (St. Mary Parish). IP 350 BOPD, ⅛-in., 34.2°, GOR 703 cu. ft. per barrel, TP 2,450 psi., perforations 9,272-78 ft. TD 9,901 ft. (New pay in Eugene Island Block 188 field.)

BRITISH COLUMBIA

Gulf States 7 Gundy Creek, Unit 2 Zone G N.T.S. Map 94-B-16. Cadomin gas discovery. TD 5,038 ft.

SASKATCHEWAN

Shell Oil Co. 3-25 Burnett, LSD 4, 25-3-1w2. Mission Canyon oil discovery. TD 4,185 ft.

KANSAS

Barton County: Petroleum, Inc., 2 Rude, SW NE NE 1-16s-13w. IP 58 BOPD, 13% water, 32°, 2,940-50 ft. TD 3,390 ft. New pay in South Ney pool.

E. V. McCOLLUM, new SEG chief, contends, with good reason, that . . .

Geophysics Still Has Vital Role

THE PRESIDENT-ELECT of the Society of Exploration Geophysicists has no magic cure for the ills of the geophysical industry. His advice is simple and direct: Improve the product.

E. V. McCollum, Tulsa, takes over in October as the leader and spokesman for 5,500 SEG members whose position in the petroleum world has been the subject of wide discussion in recent months.

An accounting firm has made a study of the operations of 13 leading geophysical firms and come up with alarming figures showing that since 1954 the companies have suffered average net losses each year (OGJ, July 14, p. 72).

McCollum is not impressed with the argument that geophysicists are running out of structures to test in the U. S.

While there is a limited amount of truth to such an argument, McCollum says, he takes the position that oil companies have a lot of "tough" areas yet to master. And they abound in some of the greatest oil provinces in the country—the Anadarko basin of Oklahoma and neighboring states, the Four Corners, and many spots in the Rockies.

"Through refinements and more basic research we will be able to do better on the tougher problems," he said.

"We can improve our product through more study and collection of data on fundamentals, such as better determination of densities, velocities, and magnetic susceptibilities. We can do better interpretation."

Not up to SEG . . . The job of improving geophysical techniques is not one that falls directly on the organization which McCollum soon will head, he says.

Oil companies and geophysical contractors must move ahead with their own research programs to prove the worth of the geophysicist in the oil-finding business.

The SEG, now 28 years old, is not a research outfit. It serves as a clearing house for exchange of ideas through scientific papers presented at its annual meetings. And it encourages students to enter the geophysical field.

But the SEG has no plans for financing laboratories or research.

Personal history . . . Though only 54 years old—and he doesn't look that—McCollum was virtually a pioneer in his field.

As a young college graduate he joined the first geophysical laboratory in the country at the old Marland Oil Co. at Ponca City, Okla.

Actually, McCollum wasn't trained as an oil man but as a physicist. He found, however, that his job was simply one of applied physics.

McCollum was reared at Helena, a small northwestern Oklahoma town. He took his A.B. and M.S. degrees in physics from the University of Oklahoma in 1925 and 1926. He won a Phi Beta Kappa key.

At the Marland company McCollum worked in the laboratory and in the field and learned to make seismographic equipment and over-

▶ ▶ ▶ Personals

H. V. Aiguier, tool pusher with Helmerich & Payne, Inc., has been transferred from Andrews to Fort Stockton, Tex.

Richard B. Palmer has been promoted to assistant division geologist with The Texas Co. in Fort Worth, Tex. He was formerly staff geologist with Texaco at Houston.

Frank G. Kozak will represent Exeter Drilling Co. in Casper, Wyo. He is a graduate of the University of Colorado and since then has been active in the oil industry in the Rocky Mountain area.

Holland Howell has resigned as chief engineer of Republic Oil Refining Co., Texas City, to become president of Refinery Construction Co. of Houston.

William Cole, production engineer with Carter Oil Co., has been transferred from Magnolia, Ark., to Shreveport, La.

John M. King of King-Stevenson Oil Co. has been elected president of the newly formed Tioga Petroleum Corp., Chicago. **Frank A. Dixon, Jr.,** is the company's vice president in charge of the land department, and **Ben T. Stevenson** is vice president of the production department.

Louis Franklin and son, **Jack Franklin,** independent oil operators, have moved their office from Coleman to Abilene, Tex.

J. P. Terry succeeds the late Paul J. Hallicy as president of Holly Development Co., Huntington Beach, Calif. Terry has been superintendent of Holly's operations since 1941 and a director since 1956.

Carroll F. Knutson has been promoted to research engineer in Continental Oil Co.'s production-research division. He was previously employed in Conoco's production department in Houston. His new headquarters will be in Ponca City, Okla.

haul magnetometers and torsion balances.

When Continental Oil Co. absorbed Marland in 1929, McCollum stayed on with Conoco as control geophysicist for 10 years until, in 1939, he resigned to join the Mott-Smith Corp. at Houston as chief geophysicist.

Four years later he and a Mott-Smith associate, Craig Ferris, resigned to go into the geophysical contracting business. They formed E. V. McCollum & Co., with headquarters in Tulsa.

It took them 3 or 4 months to get their first job—and it was, of all places, in Alabama. Since then the McCollum company has sent its crews throughout the United States and the world. It has had as many as 12 crews working at once, though during the present oil business doldrums it has only six.

McCollum is in the international field through a three-company combine known as Namco. It has crews in Libya, Guatemala, and Panama.

Problems . . . McCollum readily admits that geophysical companies are having rough sledding.

Contract prices are not what they should be, he says, but neither is the price of oil. Oil companies are forced to pay high prices for wages and steel, and its the contractors—such as drillers and geophysicists—who get the leftovers.

"Maybe we have gone over the peak," McCollum says, "but they will need us for many years to come. You can't dream up where oil-bearing structures are. You have to go out and find them.

"I don't know whether we will keep going at the present level, but there will always be a geophysical industry as long as oil is being sought."

Lloyd J. Beckman has been elected a director and secretary of Cities Service Oil Co. He succeeds **F. B. Plank** who retired August 31.

Frank O. Prior, chairman of the board and chief executive officer of Standard Oil Co. (Ind.), has been elected a director of Chase Manhattan Bank.

W. B. Cleveland has resigned as a director of Carter Oil Co. and will resume his former affiliation with Creole Petroleum Corp. in Caracas. Prior to his Carter appointment last November, Cleveland was manager of Creole's Amuay refinery at Las Piedras, Venezuela.

S. L. Creech, field superintendent, and **Hugh C. Williams,** engineer, both with Texas Eastern Transmission Corp., have been transferred from Shreveport, La., to Houston.

Willis M. Decker, Oklahoma City district geologist in charge of development for Cities Service Oil Co., has been assigned additional duties in exploration. He has been district geologist since 1951. Prior to that he was development geologist at Oklahoma City.

Dr. Orland M. Reiff and **Paul B. Weisz,** Socony Mobil Oil Co., Inc., have been named to the newly created positions of senior research associate at the company's research and development laboratory, Paulsboro, N. J. Reiff is a chemist, and Weisz a physicist.

Harry E. McDonald, formerly in the oil department of the Mercantile National Bank of Dallas, has joined Utah Southern Oil Co., Denver, as production superintendent. **Karl R. Kuhn,** Utah Southern office manager, has been elected treasurer and assistant secretary of the company.

Forrest S. Warren, formerly Gulf Coast manager for Texas Natural Gasoline Corp., has been appointed vice president. In his new position, he will continue to devote the greater part of his time to administrative work in the Gulf Coast division. He will also be in charge of all sales to the refining and petrochemical industries along the Gulf Coast and Eastern Seaboard.

Dr. James N. Pitts, Jr., associate professor of chemistry at the University of California's Riverside campus, has been named a consultant to Shell Development Co. During a leave of absence from the university he will carry out basic research in the company's radiation laboratory and will conduct a seminar on photochemistry for the lab staff at the Emeryville research center.

Carl E. Reistle, Jr., executive vice president of Humble Oil & Refining Co., has been named national chairman of the petroleum industry building fund committee for the United Engineering Center building program in New York. Co-chairman is **Basil P. Kantzer,** vice president of Union Oil Co. The proposed 20-story building will cost $10,000,000. It will be headquarters for 16 engineering societies when completed in 1969 (OGJ, Dec. 2, 1957, p. 68).

▶▶▶ Personals

CRENSHAW

Kirby E. Crenshaw is the new president of Cities Service Gas Co., Oklahoma City. He succeeds **Harry D. Hancock,** who is retiring after serving the Cities Service system since 1912. Crenshaw started with Cities Service as a junior engineer in 1930. He joined Gas Advisers, Inc.,, a Cities Service subsidiary, in 1940, and became vice president in 1947. In 1956 he became Cities Service's executive vice president. Crenshaw is also president and a director of Cities Service Gas Producing Co.

Olen L. Riggs, Jr., has been promoted by Continental Oil Co. to research chemist in the special research section, Ponca City, Okla.

R. M. Stephens, formerly assistant sales manager for Humble Oil & Refining Co., has been named assistant to the manager of the newly organized marketing department.

Mehemet Wiggen, technical specialist in the technical division at Humble Oil & Refining Co.'s Baytown, Tex., refinery, has retired. He joined Humble in 1921.

Dr. Louis E. Ott and **Dr. Henry R. Menapace** are among recent appointees to the staff of the Whiting Research Laboratories of Standard Oil Co. (Ind). Ott will conduct research on petroleum asphalts. Menapace, formerly associated with Monsanto Chemical Co., will conduct research on the chemistry of petroleum fuels.

Mike Bealessio, formerly San Joaquin Valley district engineer with Tidewater Oil Co., has been transferred to Ventura, Calif., as coastal district engineer. His former position is being filled by **Ernie Young,** who was area petroleum engineer at Bakersfield. **Vic Guidera,** formerly civil engineer, succeeds Young.

William W. Wingate has been promoted from assistant manager to manager of the Mid-Continent region of Du Pont Co.'s petroleum-chemicals division, Tulsa. He succeeds **Charles D. Towery,** who has been manager of both the Mid-Continent and Gulf Coast regions. Towery will now devote full time to management of the Gulf Coast regional office in Houston.

Personals

William R. Cotten has joined The California Co. as production engineer at Harvey, La. He was formerly a student at Louisiana State University.

F. G. Phillips, division exploitation engineer with Shell Oil Co., has been transferred from Franklin, La., to Shell's new division office at Lafayette, La.

Charles C. Dilley is a new director of Pure Oil Co., succeeding **John H. McCoy,** who resigned. Dilley is the founder and former president of Benzoco, Inc., Akron, Ohio, a service-station chain which Pure acquired in 1955.

Emory Parrott, district manager and geologist for Champlin Oil & Refining Co. at Abilene, Tex., has been transferred to Midland. The company has merged its West Central district at Abilene with the West Texas district at Midland. **W. D. Young,** district landman, and **Bill Keller,** geologist, were transferred from Abilene to Oklahoma City. **Doyle H. Elich,** geologist; **Ted Boss,** scout; and **Paul Shelton,** production superintendent, remain in Abilene.

Dr. Karl Dittmer, head of the department of chemistry at Florida State University, is the new program administrator for American Chemical Society's Petroleum Research Fund.

CRAM

Ira H. Cram, Houston, senior vice president of Continental Oil Co., has been elected chairman of the executive committee of Continental's board of directors. He succeeds **E. F. Battson,** New York, who recently retired as a director. Cram joined Conoco in 1949 as vice president and manager of exploration. He was elected to the board in 1952. He is a former president of the American Association of Petroleum Geologists.

Howard F. Bjork, formerly president of Althouse Chemical Co., has joined Weinrich & Associates, chemical engineers in Washington, D. C. At one time he was vice president in charge of manufacturing for Sharples Chemicals, Inc., and also served as director of manufacturing and general manager of the Sharples division of Pennsalt Chemicals Corp.

Reservoir Engineer Honored by Humble

T. A. Huber, right, assistant chief petroleum engineer for Humble Oil & Refining Co., has been honored by the company for his achievements in reservoir engineering. Presenting the plaque to Huber is **C. E. Reistle, Jr.,** Humble executive vice president.

Huber's certificate states that "with prophetic vision, the recipient pioneered and actively promoted the application of reservoir engineering from its modest beginning to its present eminence and thereby contributed immeasurably to the economic growth of Humble. He has set a pattern followed by industry for the application of reservoir engineering in production operations."

Huber was chief reservoir engineer with Humble from 1950 to 1953 when he was promoted to his present position.

Donald Edward Todd has joined Warren Petroleum Corp. as a chemical engineer trainee at Maysville, Okla., after completing his studies at Texas A. & M. College.

Howard T. Hampton and **D. Wayne Benson,** geologists, are now associated with William J. Seidl, consulting geologist. Hampton was formerly with Seaboard Oil Co., and Benson was with Kerr-McGee Oil Industries, Inc.

Kent H. Smith, chairman of the board of Lubrizol Corp., has been named acting president of Case Institute of Technology, Cleveland. He will serve until the return of Case **Pres. T. Keith Glennan,** who is on leave as head of the National Aeronautics and Space Administration in Washington.

John W. Tynan has been promoted to production manager for Continental Oil Co.'s Rocky Mountain region with headquarters at Denver. Tynan joined Conoco as a production engineer in 1950. During the past 3 years he had been regional engineer at Denver. Tynan succeeds **J. C. (Jimmy) Johnston,** who retired August 29.

T. H. Tonnessen, former manager of the finance division of Standard Oil Co. (N. J.), is now assistant treasurer of the company. He joined Jersey as an economic analyst in 1945, and his assignments have included senior foreign exchange analyst and international financial analyst.

Lloyd J. Beckman becomes secretary and a director of Cities Service Oil Co., Bartlesville, Okla., effective this month. He succeeds **F. B. Plank,** who retired August 31 after 40 years service with the company. Beckman, who joined the company's marketing division in 1929, has been assistant secretary since 1953.

David T. Searls is the new general counsel of Gulf Oil Corp., effective this month. He succeeds **Archie D. Gray,** who was named senior vice president last spring. Searls was a senior partner of Vinson, Elkins, Weems & Searls of Houston before his recent appointment. He is vice president and director of the Almeda State Bank of Houston and director of Oil Center Tool Co., Houston. Searls was a chief witness during House hearings on the Harris bill in 1955.

Dr. Donald B. Gould will fill the newly created position of administrative geologist for Geophoto Services, Ltd., Calgary. He joined the company in 1951 at Denver.

D. R. Briggs, petroleum engineer with Magnolia Petroleum Co., Monahans, Tex., is now serving in the Air Force as a second lieutenant in Denver.

Col. Kenneth A. Gaskin (USAF, Ret.) is coordinator of Atlantic Refining Co.'s newly formed aviation product sales department. The new department is part of an expansion of the firm's jet fuel marketing program.

Francis E. Heath, chief geologist for Sun Oil Co.'s southwest division in Dallas, has been appointed agent and chief geologist there. He has power of attorney to act for the division and will take over as head of the division in the absence of the manager and assistant division manager. Heath has been with Sun since 1926.

Dr. F. W. Oudt, New Orleans area exploration manager for Shell Oil Co. since 1946, has been promoted to executive assistant to the vice president. He succeeds **W. M. Johnson,** who will continue to assist the vice president with industry affairs and special assignments. **G. A. Burton,** area geologist, succeeds Oudt. Burton has been on special assignment in the company's New York office the past year. Prior to that he was area geophysicist and later manager of the marine exploration group.

OUDT

BURTON

W. H. Blackledge will be Western Hemisphere manager of Gulf Oil Corp.'s new crude-oil department created to handle all sales, purchases, and exchanges of crude outside the U. S. He will headquarter in Pittsburgh. **P. J. H. Clancy** will be manager for the Eastern Hemisphere with an office in London. Both men have been with the foreign crude-oil sales department since it was formed in 1954.

J. E. Embry, assistant general superintendent in the production division of Arkansas Fuel Oil Corp., Shreveport, has been named general superintendent. He succeeds **R. W. Sole,** retired. **J. D. Norris,** formerly drilling superintendent at Alice, Tex., is now general drilling superintendent in Shreveport.

Dr. Troy L. Pewe is the new head of the department of geology at the University of Alaska. Until his appointment he served as geologist in charge, U. S. Geological Survey, Alaskan Geology Branch at College. He received his doctorate at Stanford University.

Comdr. Morriss H. Kelley, USNR, is Richfield Oil Corp.'s new manager of tanker operations. He will headquarter at the company's marine terminal offices in the Long Beach Harbor area. Kelley has been port engineer for Richfield since 1950.

Ben S. Smith, Jr., will fill the newly created position of director of services for Murphy Corp. The new position was established to centralize the general service functions performed for the parent company and its affiliates. Smith has served in various departments of Lion Oil Co. and became director of personnel in 1951. Early this year he moved to the home office of Monsanto Chemical Co. in St. Louis.

Paul Millsapps succeeds **Henry K. Arnold** as secretary and assistant treasurer of Humble Oil & Refining Co., Houston. Arnold has retired after more than 40 years with the company. Part of this period he headed pollution activities for the production department and was associated with early studies on salt-water disposal in East Texas field. Millsapps has been with Humble more than 38 years and was assistant secretary before the new appointment.

Dr. W. F. Faragher has been appointed assistant to the president of Temple University Research Institute, which now plans to extend its work to the petroleum field. Faragher is founder of the school of petroleum engineering at the University of Pittsburgh. He was later in charge of the research and development laboratories of Universal Oil Products Co., and then joined the old Vacuum Oil Co. He has long been associated with Eugene J. Houdry, well known for his work in developing the catalytic cracking process.

▶ ▶ ▶ Personals

Richard W. Coburn has been appointed vice president in charge of field operations for W. E. Stiles Engineering, Inc. He will direct all drilling and producing operations on oil and gas properties managed by the company. Coburn was formerly district superintendent and assistant to vice president for production for Champlin Oil & Refining Co. He is chairman of the API's Northern Oklahoma chapter.

F. W. Mitchell, chief geologist with Calvert Drilling, Inc., has been transferred from Olney, Ill., to Oklahoma City. Mitchell started with Calvert as a consultant in 1946.

George W. Harris, Jr., area land agent for Shell Oil Co. at Denver, has been transferred to Tulsa as senior landman. Harris joined Shell in Donaldsonville, La., in 1937.

M. G. Peeters, manager of Socony Mobil Oil Co.'s Wadhams division, is retiring this month after 38 years with the company. Peeters was vice president of Wadhams Oil Corp., Milwaukee, before the company became a part of Socony in 1931.

▶ ▶ ▶ Deaths

S. W. Morsehead, 84, pioneer California independent oil producer, died August 17 at Lake Tahoe. Morsehead, an honorary director of Union Oil Co., was one of the founders of Coalinga Oil Producers Association, now known as Independent Oil Producers Agency of California.

Seaborn L. Digby, 66, former Louisiana conservation commissioner and later a member of the Federal Power Commission, died in Monroe, La., August 19 following a brief illness. He retired from the FPC in June.

Clyde Snodgrass, 68, retired tax commissioner for Sinclair Oil & Gas Co., Tulsa, died August 23 in Smithtown, N. Y., after a heart attack. He joined Prairie Oil & Gas Co. at Independence, Kans., in the 1920's and became Sinclair's tax commissioner in 1945. He held that position until his retirement in 1955.

Gas still crowding distillate fuel

BY JOHN C. CASPER
Economics Editor

HOME OWNERS have been buying more natural gas than distillate fuel since about 1952 and they widened the gap still more in favor of gas last year.

The latest survey by the Bureau of Mines shows that sales of distillates for heating amounted to 360,212,000 bbl. in 1957. No. 1 fuel, sold as range oil, added another 16,832,000 bbl. for an over-all total of 377,044,000 bbl.

Preliminary figures on sales of natural gas in 1957 show residential deliveries of 2,492 billion cubic feet. On an energy basis, this is equivalent to about 442,600,000 bbl. of distillate fuel. Thus, residential gas use topped light-heating-oil consumption by 17%.

Some of this distillate was used for heating offices and other commercial buildings, and much of the gas was used for cooking and water heating.

These differences limit the comparisons that can be made between gas and distillate sales. However, the chart on this page does show that gas has made some rapid gains in the past few years. The lines on the chart represent total sales of heating distillates in comparison with residential and commercial consumption of natural gas.

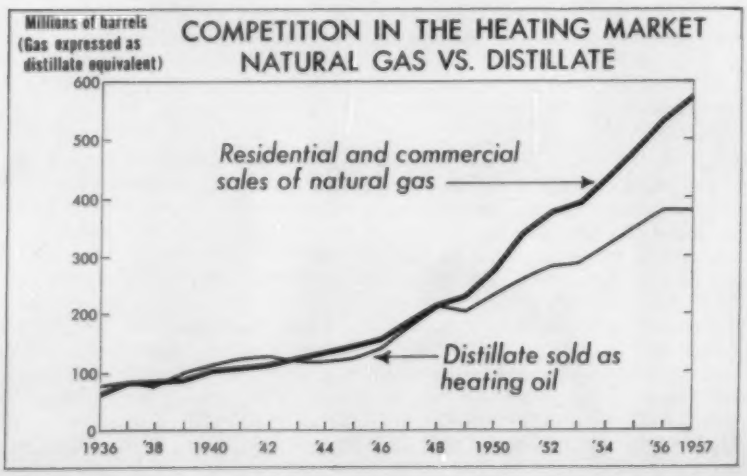
A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,855,550	UP	22,125	UP	79,475
Crude stocks	250,038,000	UP	242,000	DOWN	36,580,000
Completions	937	DOWN	49	DOWN	138
Refinery runs	7,905,000	UP	192,000	DOWN	65,000
Gasoline stocks	173,756,000	DOWN	2,731,000	UP	1,859,000
Kerosine stocks	27,548,000	UP	530,000	DOWN	5,671,000
Distillate stocks	136,600,000	UP	4,833,000	DOWN	17,071,000
Residual stocks	66,792,000	DOWN	373,000	UP	14,555,000
Four-product stocks	400,696,000	UP	2,259,000	DOWN	6,328,000
Total imports	1,441,000	UP	47,100	DOWN	168,800

SALES OF HEATING DISTILLATES*
(Thousands of barrels)

District—	1957	1956	1955	1954	1953
PAD 1	222,062	221,544	207,716	188,007	161,912
PAD 2	121,549	121,121	113,684	100,853	91,101
PAD 3	4,735	4,682	3,948	3,967	3,702
PAD 4	6,246	6,173	5,942	5,191	4,738
PAD 5	22,452	23,742	25,299	22,099	21,647
Total U. S.	377,044	377,262	356,589	320,117	283,100

*Bureau of Mines. Includes No. 1 sold as range oil.



NATURAL GAS and heating distillate grew at about the same rate from 1936 through 1948. Since that time, gas has held an ever-increasing lead.

Distillate topped gas for 4 years, starting with 1939, but gas moved ahead during the war. Since the end of World War II, gas has extended its lead over distillate.

The sharpest change came last year. Sales of heating distillates gained only 0.1% over 1956, and No. 1 range oil dropped 3.5%. Total sales for heating were down slightly.

Since economic changes have very little influence on heating-oil sales in a single year, the lack of gain in 1957 can be charged to warmer-than-normal weather and to gas competition.

The 6.4% gain by natural gas in the residential-commercial market shows the degree of this competition.

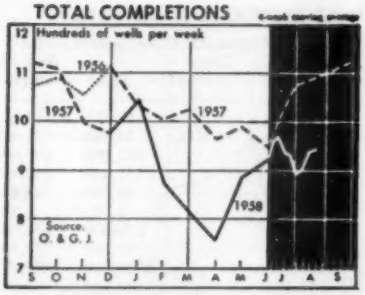
Gasoline Markets Are Softening

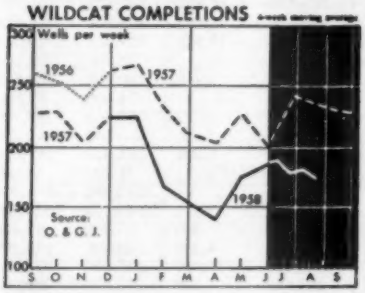
Tank-wagon cuts on the East Coast, drop in spot buying on the Gulf Coast, and shaded Group 3 prices are indicators of end-of-the-season softening of the gasoline market.

Gasoline tank-wagon prices have been cut twice in Boston over the past few weeks. A cut of 2 cents was reported for Buffalo. There were unconfirmed reports of discounts in several New England cities that ranged up to a cent and a half a gallon.

While there have been no reports of large-scale discounting of gasoline on the Gulf Coast, market rumors indicate that some material is available at shaded prices. Top grades are softer than regular.

The unbranded jobber can find Group 3 regular gasoline for 11.75 cents without too much trouble.





Active Rotary Rigs*

	8-25-58	8-18-58	8-26-57
Alabama	6	6	4
Arkansas	25	23	25
Arizona	2	2	....
California	73	74	102
Colorado	38	42	62
Florida	1	1	1
Georgia	....	....	....
Idaho	....	....	....
Illinois	59	47	46
Indiana	10	8	9
Iowa	3	3	2
Kansas	159	149	157
Kentucky	6	4	14
Louisiana	293	302	455
North	32	42	67
South	225	223	284
Offshore	36	37	104
Maryland	....	....	1
Michigan	10	10	14
Missouri	1	....	....
Montana	20	24	30
Mississippi	41	44	38
Nebraska	23	25	32
Nevada	....	....	1
New Mexico	104	104	166
New York	2	1	....
North Dakota	27	30	32
Ohio	....	....	1
Oklahoma	209	207	244
Oregon	....	....	1
Pennsylvania	10	11	12
South Dakota	3	3	....
Texas	669	684	910
Gulf Coast	137	134	207
Offshore	....	1	3
West	268	280	357
North	213	219	292
East	51	50	51
Tennessee	....	....	1
Utah	31	32	64
Washington	1	1	1
West Virginia	6	5	5
Wyoming	62	68	77
Virginia	....	....	1
Total U. S.	1,894	1,910	2,508
Western Canada	157	142	189
Eastern Canada	2	2	3
Grand total	2,053	2,054	2,700

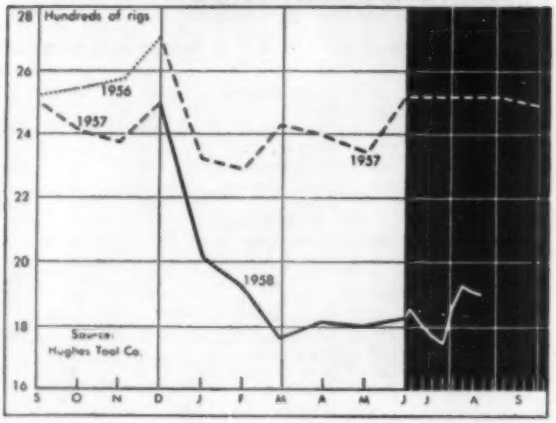
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 23, 1958

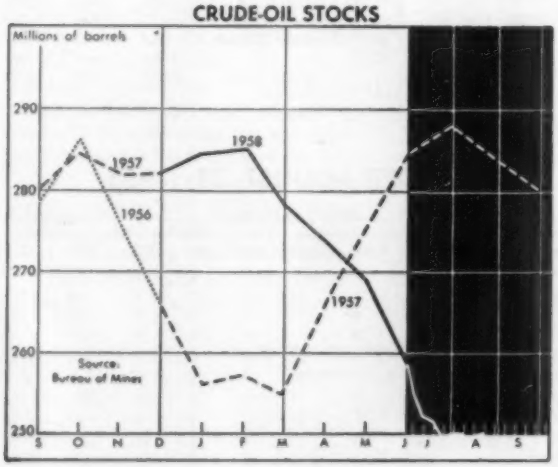
	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	3	2	0	0	1	0	23,595	48	62	1	0	0	0	1	18	20
Arkansas	16	10	0	1	5	0	47,779	462	707	4	0	0	1	3	109	129
California	18	11	0	0	7	0	91,075	1,051	1,388	4	0	0	0	4	239	344
Colorado	12	2	0	1	9	0	66,323	510	548	8	0	0	0	8	294	371
Illinois	46	17	0	0	29	0	112,640	1,358	1,646	7	0	0	0	7	263	421
Indiana	23	6	0	0	17	0	40,312	473	399	5	0	0	0	5	174	80
Kansas	76	31	0	8	35	2	261,749	2,407	2,704	21	3	0	3	15	513	545
Kentucky	36	16	0	2	18	0	48,098	710	921	7	0	0	1	6	82	182
Louisiana	85	40	8	2	35	0	593,531	2,189	2,440	13	0	1	0	12	316	435
North	40	16	0	1	23	0	146,404	784	858	11	0	0	0	11	126	114
South	33	15	8	1	9	0	322,498	1,115	1,122	1	0	1	0	0	171	263
Offshore	12	9	0	0	3	0	124,629	290	460	1	0	0	0	1	19	58
Michigan	7	3	0	0	4	0	19,682	270	264	1	0	0	0	1	90	99
Mississippi	11	4	0	0	7	0	93,050	252	236	3	0	0	0	3	118	126
Montana	10	7	0	0	3	0	35,401	213	256	2	0	0	0	2	90	93
Nebraska	8	1	0	0	7	0	51,976	441	577	5	0	0	0	5	210	319
New Mexico	46	17	1	16	12	0	215,529	1,282	1,361	6	0	1	0	5	166	181
West	24	2	1	16	5	0	111,531	621	544	4	0	1	0	3	73	67
East	22	15	0	0	7	0	103,998	661	817	2	0	0	0	2	94	114
New York	38	25	0	0	0	13	39,230	393	297	0	0	0	0	0	32	4
North Dakota	13	8	0	0	5	0	70,395	292	176	3	0	0	0	3	95	76
Ohio	6	2	0	1	1	2	13,340	669	710	1	0	0	0	1	9	9
Oklahoma	131	63	2	8	51	7	404,139	4,110	4,025	12	1	0	1	10	569	456
Pennsylvania	58	41	0	0	3	14	120,280	418	442	0	0	0	0	0	9	39
Texas	259	159	14	10	74	2	1,119,397	11,482	14,132	46	6	1	1	38	2,323	3,480
Dist. 1	12	0	1	0	11	0	37,957	628	820	5	0	0	0	5	252	287
Dist. 2	13	5	0	1	7	0	64,105	488	496	4	0	0	0	4	128	187
Dist. 3	19	7	4	0	8	0	122,234	826	1,133	4	0	0	0	4	181	330
Dist. 4	16	6	2	2	6	0	69,496	767	916	4	0	0	0	4	222	309
East	21	14	4	0	3	0	77,666	780	835	3	0	1	0	2	216	244
Dist. 7-B	27	21	0	0	6	0	124,883	1,538	1,853	6	1	0	0	5	430	661
West	67	53	0	0	14	0	313,693	3,333	4,014	9	1	0	0	8	461	588
Dist. 9	51	34	0	1	14	2	171,646	2,317	3,129	8	4	0	0	4	368	802
Dist. 10	33	19	3	6	5	0	137,717	805	936	3	0	0	1	2	65	72
Utah	6	3	0	0	3	0	33,168	262	133	2	0	0	0	2	56	72
West Virginia	18	1	0	13	4	0	45,196	458	417	0	0	0	0	0	12	19
Wyoming	10	1	0	2	7	0	51,501	467	545	6	0	0	0	6	134	188
Misc. (Florida)	1	0	0	0	1	0	6,915	63	65	1	0	0	0	1	55	48
Total U. S.	937	470	25	64	338	40	3,604,301	30,280	34,451	158	10	3	7	138	5,976	7,736
Prev. week	986	468	31	106	354	27	4,022,727	....	....	166	15	4	0	147	....	....
Cum. 1958	30,280	14,913	743	2,303	11,540	781	126,038,829	....	....	5,976	590	102	182	5,102	....	....
Western Canada	40	28	0	3	5	4	212,921	1,557	1,993	3	1	0	0	2	428	570

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



DAILY AVERAGE PRODUCTION FOR WEEK

	August 23, 1958 Crude oil	Lease condensate	Total	Aug. 16 total
Alabama	17,075	.....	17,075	17,050
Arkansas	74,550	250	74,800	74,525
California	852,100	.....	852,100	850,800
Colorado	131,800	.....	131,800	132,500
Eastern	47,300	.....	47,300	46,800
Florida	1,275	.....	1,275	1,275
Illinois	220,600	.....	220,600	226,000
Indiana	31,700	.....	31,700	31,800
Kansas	†335,050	.....	†335,050	†329,375
Kentucky	41,100	.....	41,100	41,700
Louisiana	765,800	81,925	847,725	843,075
North	106,300	2,400	108,700	104,050
South	659,500	79,525	739,025	739,025
Michigan	25,200	.....	25,200	25,200
Mississippi	96,600	3,950	100,550	100,550
Montana	78,400	.....	78,400	77,800
Nebraska	57,400	.....	57,400	57,100
Nevada	100	.....	100	100
New Mexico	272,400	5,000	277,400	277,400
North Dakota	36,200	.....	36,200	34,500
Oklahoma	†573,400	.....	†573,400	†554,700
Texas	2,627,000	62,100	2,689,100	2,689,100
Dist. 1	45,000	400	45,400	45,400
Dist. 2	116,000	8,200	124,200	124,200
Dist. 3	345,000	31,000	376,000	376,000
Dist. 4	192,000	8,000	200,000	200,000
Dist. 5	32,000	275	32,275	32,275
Dist. 6	117,000	6,000	123,000	123,000
East Texas field	153,000	.....	153,000	153,000
Dist. 7-B	142,000	75	142,075	142,075
Dist. 7-C	131,000	4,050	135,050	135,050
Dist. 8	1,045,000	1,800	1,046,800	1,046,800
Dist. 9	204,000	1,500	205,500	205,500
Dist. 10	105,000	800	105,800	105,800
Utah	105,600	.....	105,600	95,600
Wyoming	327,000	.....	327,000	326,300
Others	‡175	.....	‡175	‡175
Total U. S.	**6,717,825**	153,225	**6,871,050**	6,833,425
Change from previous week, up			**37,625**	
Canada	†473,800	.....	†473,800	†440,900

Total U. S. production, January 1-August 23 1,526,254,950 bbl.
Same period last year (crude plus cond.) *1,724,778,939 bbl.

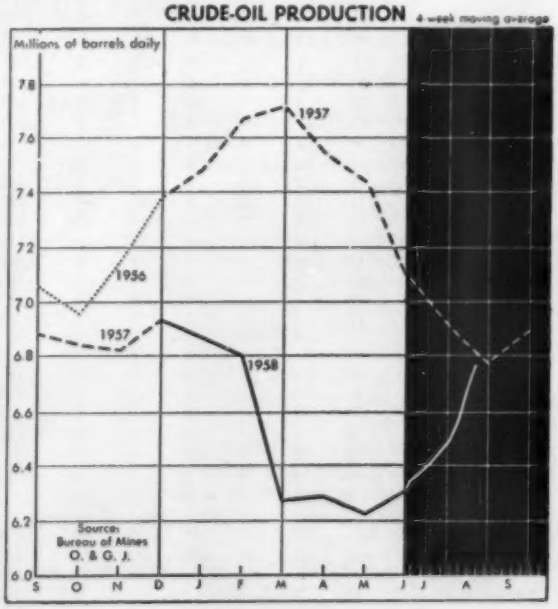
*Includes 32,998,825 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Washington.

CRUDE-OIL STOCKS BY STATES OF ORIGIN*
(Thousands of barrels)

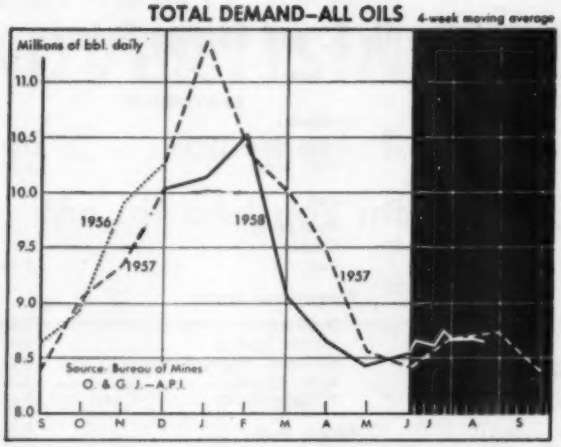
	8-16-58	8-9-58	8-17-57
Pennsylvania	2,874	2,872	3,158
Other Appalachian	1,469	1,477	1,624
Illinois, Indiana, Michigan	10,986	11,053	11,106
Nebraska and North Dakota	2,046	2,097	2,546
Kansas	9,722	9,782	10,810
Oklahoma	15,574	14,948	22,990
Arkansas	1,880	1,951	2,743
Louisiana	16,636	16,671	18,577
North	2,898	2,802	3,082
South	13,738	13,869	15,495
Mississippi, Alabama, Florida	2,427	2,265	2,665
New Mexico	7,081	6,182	8,716
Texas	102,458	101,153	131,376
East Texas	8,211	7,259	10,765
West Texas	49,311	49,136	64,408
Texas Gulf	18,770	19,351	24,292
Other Texas	26,166	25,407	31,911
Wyoming	13,738	14,604	17,835
Other Rocky Mountain	9,861	9,725	6,285
California	36,789	37,940	30,075
Foreign	†16,497	17,076	16,112
Total	**250,038**	249,796	286,618

*Bureau of Mines. †Includes 5,760,000 bbl. in California.

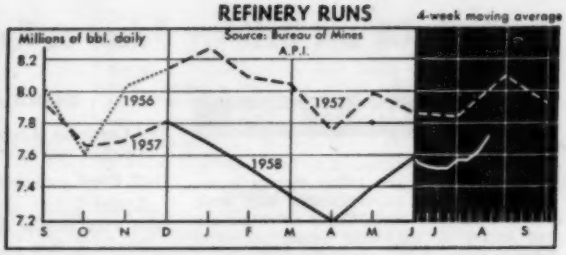
CRUDE-OIL PRODUCTION 4-week moving average



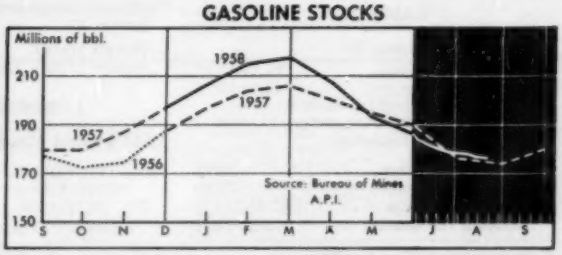
TOTAL DEMAND—ALL OILS 4-week moving average



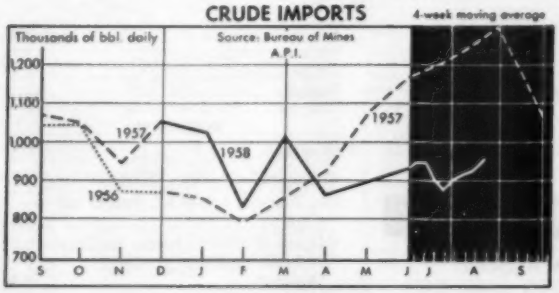
REFINERY RUNS 4-week moving average



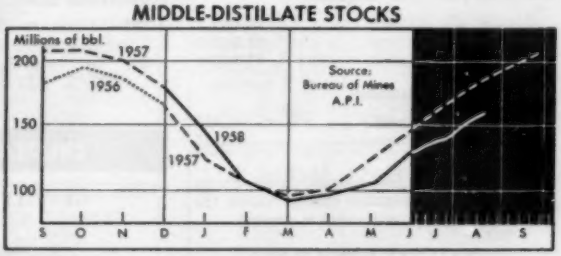
GASOLINE STOCKS



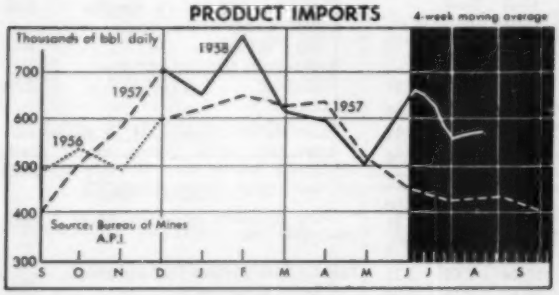
CRUDE IMPORTS 4-week moving average



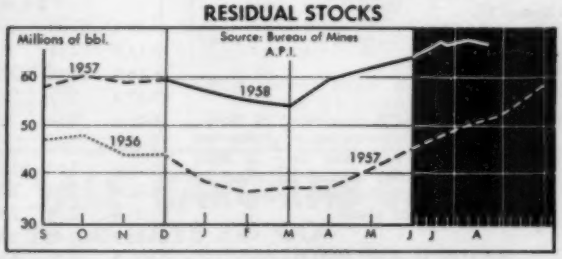
MIDDLE-DISTILLATE STOCKS



PRODUCT IMPORTS 4-week moving average



RESIDUAL STOCKS



API REFINERY REPORT—AUGUST 22, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, August 1957 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist	Resid.
East Coast	1,111	475.4	17.0	264.0	189.3	39,769	9,961	43,787	12,711	1,283	530.9	22.0	334.6	237.7
Appalachian:														
District 1	100	46.8	2.3	22.4	3.9	4,460	520	2,975	392	98	44.7	3.4	21.9	5.4
District 2	106	58.6	6.0	18.9	8.8	2,207	501	1,331	284	68	37.0	2.3	10.3	8.1
Ind., Ill., Ky.	1,375	725.1	61.3	283.9	107.4	33,215	6,954	23,533	5,503	1,332	694.9	52.2	263.3	135.8
Minn., Wis., Dak.	112	53.9	3.1	30.7	10.4	6,764	1,490	7,323	563	105	50.1	7.5	26.7	8.1
Okla., Kans., Mo.	756	428.6	19.4	174.3	27.4	16,888	1,715	12,683	1,074	744	419.0	14.7	165.0	28.2
Inland Texas	277	189.4	6.0	52.7	18.0	6,505	384	1,862	1,958	286	210.6	8.0	52.8	21.3
Texas Gulf Coast	1,851	936.7	87.9	459.1	189.1	21,847	2,635	14,511	8,347	1,917	990.5	92.7	505.2	231.2
La. Gulf Coast	663	363.1	45.3	135.7	52.3	8,795	1,714	5,411	1,639	656	358.3	33.6	168.1	45.4
N. La. and Ark.	103	47.6	5.0	25.6	5.4	4,523	1,012	1,946	191	91	32.2	5.3	19.2	6.8
Rocky Mountain:														
New Mexico	18	13.4	.....	3.4	0.9	360	16	149	45	28	14.9	0.3	4.9	3.7
Other Rky. Mt.	279	128.7	1.3	50.6	34.4	4,869	271	3,030	956	292	141.3	4.2	63.2	36.6
West Coast	1,154	546.3	1.3	193.6	311.3	23,554	375	14,059	33,127	1,192	517.1	5.5	170.6	320.5
Aug. 22, 1958	7,905	4,013.6	255.9	1,714.9	958.6	173,756	27,548	132,600	66,792	8,092	4,041.5	251.7	1,805.8	1,088.8
Aug. 15, 1958	7,713	3,939.6	278.6	1,661.1	985.3	176,487	27,018	127,767	67,165	.....	.....	.....	.....	.....
Aug. 23, 1957	7,970	3,999.9	264.4	1,772.4	1,101.9	171,897	33,219	149,671	52,237	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (89 octane)	11.75-12.25
★ Premium (99 octane)	14.75-15.25
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.75
Regular (92 octane)	11.00
Premium (97 octane)	12.00-12.125
Premium (98 octane)	12.125-12.25
California (rack) (Los Angeles):	
Regular (88 octane)	11.3-11.5
Premium (96 octane)	12.8-13.0
Premium (98 octane)	13.3-13.5
Caribbean area (cargoes):	
Regular (87 octane)	10.375
Premium (97 octane)	12.125

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	9.75-10.00
★ Diesel oil (58 d.i. and above)	9.50-9.75
★ Distillate No. 1	9.50-9.75
★ Distillate No. 2	8.75-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	8.875
Distillate No. 2	8.625
New York Harbor (barges):	
Kerosine 41-43	9.95
Distillate No. 2	9.45
Diesel fuel, 48-52 d.i.	10.05
Caribbean area (cargoes):	
Distillate No. 2	8.625

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank car	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.30-1.35
Gulf Coast (cargoes):	
Bunker C fuel	$2.20-2.25
New York Harbor (barges):	
Bunker C fuel	$2.57
Caribbean (cargoes):	
Bunker C	$2.25
California (rack):	
Bunker C fuel, Los Angeles	$2.45

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.§	Mid-Cont.*	Gulf Coast Tex..†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.36	....	....	....	....
15-15.9	2.41	....	....	....	$1.81
16-16.9	2.46	....	....	....	1.86
17-17.9	2.51	....	....	....	1.91
18-18.9	2.57	....	....	....	1.96
19-19.9	2.62	....	....	....	2.01
20-20.9	2.68	$2.75	....	$2.62	2.06
21-21.9	2.73	2.77	....	2.64	2.11
22-22.9	2.78	2.79	....	2.66	2.16
23-23.9	2.84	2.81	$3.44	2.68	2.21
24-24.9	2.89	2.83	3.46	2.70	2.26
25-25.9	2.95	2.85	3.48	2.72	2.31
26-26.9	3.00	2.87	3.50	2.74	2.36
27-27.9	3.06	2.89	3.52	2.76	2.49
28-28.9	3.11	2.91	3.54	2.78	2.54
29-29.9	3.16	2.93	3.56	2.80	2.59
30-30.9	3.22	2.95	....	2.82	2.63
31-31.9	3.27	2.97	....	2.84	2.67
32-32.9	3.33	2.99	....	2.86	2.71
33-33.9	3.38	3.01	....	2.88	2.75
34-34.9	3.44	3.03	....	2.90	2.79
35-35.9	....	3.05	....	2.92	2.83
36-36.9	....	3.07	....	2.94	2.87
37-37.9	....	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40-44.9	....	3.15	....	3.02	2.95

*Includes Oklahoma (sweet), part of Kansas, North Dakota, West Texas (sweet). †Low cold test crude. ‡Sour. §Some postings 3-11 cents lower.

Effective dates of broad changes: California, 6-22-58; east of California, January 3-10, 1957; Pennsylvania Grade, 6-18-58.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
★ Ville Platte	3.30
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	3.90
Middle District	3.72
Southwest Pennsylvania	3.43
West Virginia	3.25
Buckeye Grade	3.25
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.30
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25
Bachaquero, flat, 15°-16°, Las Piedras*	2.08

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

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★ Carib.-Canada, clean (USMC—40%)	$2.43
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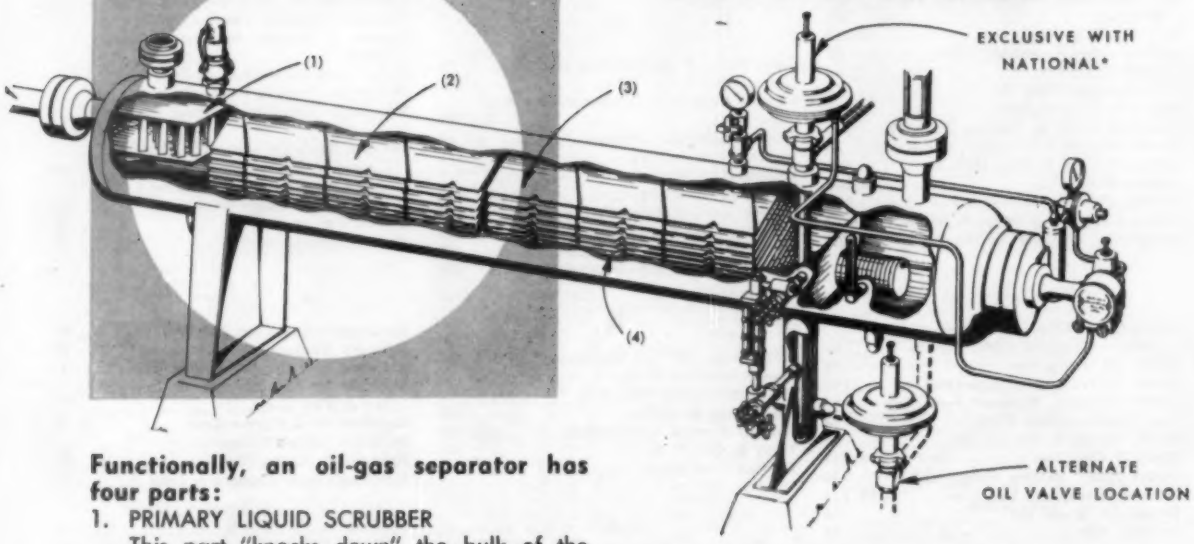

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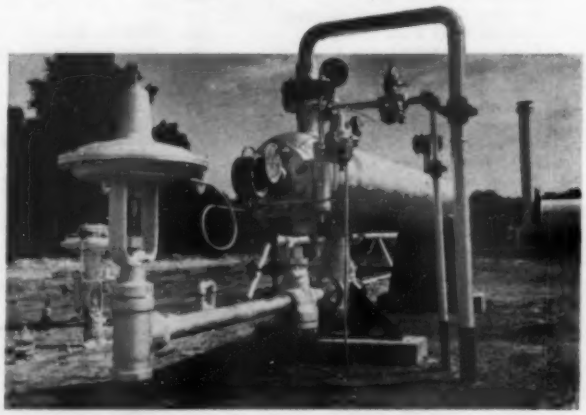
   The multiple field tests with flanged components dictated our design. National's "straight-vane" design accomplishes final liquid removal without the use of "excelsior-like" elements which are prone to be plugged with waxes, sands and other extraneous materials, including hydrates inherent in the normal oil-gas and distillate production operations.
4. OIL DE-GASSING COMPARTMENT
   What effects oil de-gassing? (a) Length of time in compartment. (b) Surface area of oil body. (c) Scrubbing surfaces to remove entrained gases. When (a), (b) and (c) are at a maximum, oil de-gassing is best. National's full-scale field testing found the proper ratios.



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